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Craggy Vegetation Management Project

Draft Environmental Impact Statement



Forest Service

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**Salmon/Scott River
Ranger District**

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Craggy Vegetation Management Project

Draft Environmental Impact Statement

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Abstract: The Craggy Vegetation Management Project (Craggy Project) was developed to improve fire resiliency on National Forest System lands by reducing fuels and stand density in strategic areas and within the wildland urban interface (WUI). This project will address the needs for 1) defensibility and resiliency to wildfires; 2) improvement to forest health (reduce density, reduce fuel loads, create fire resiliency, and improve insect and disease resistance); 3) improvement to early seral habitat for deer; 4) improvement to the fire resiliency in habitat for late-successional dependent species (northern spotted owl and fisher); 5) enhancement of habitat for the sensitive plant species, *Calochortus persistens* (Siskiyou mariposa lily); and 6) improvement to watershed concerns caused by sediment sources to streams. Alternatives considered in detail are: 1) Alternative 1, no action; 2) Alternative 2, the refined proposed action; 3) Alternative 3, an alternative that emphasizes hazardous fuel reduction adjacent to private property and decreases impacts to the northern spotted owl.

Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision-making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. *Vermont Yankee Nuclear Power Corp. v. NRDC*, 435 U.S. 519, 553 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. *City of Angoon v. Hodel* (9th Circuit, 1986) and *Wisconsin Heritages, Inc. v. Harris*, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3). In order for a reference to be considered, commenters are required to supply all referenced literature and discuss its relevancy to the project and its effects as part of their comments. The opportunity to comment ends 45 days following publication of the notice of availability (NOA) in the Federal Register. Publication of the NOA in the Federal Register is the sole means of calculating the comment period. The acceptable format(s) for electronic comments include:

plain text (.txt), rich text format (.rtf), Word (.doc, .docx), or portable document format (.pdf). Submit comments to the Craggy Project website (www.fs.usda.gov/project/?project=31770) or, send hard-copy comments to: Patricia Grantham, ATTN: Andy Mueller, fax (530) 468-1290 or mailed to 11263 N. Highway 3, Fort Jones, CA 96032-9702, or hand-delivered during normal business hours (8 am to 4:30 pm Monday through Friday, excluding holidays). For oral comments contact Andy Mueller at (530) 468-1223.

Summary

The Klamath National Forest proposes the Craggy Vegetation Management Project (Craggy Project) to improve defensibility to wildfire to the nearby communities of Yreka and Hawkinsville, CA, while improving fire resiliency on 10,600 to 11,310 acres (depending on the selected alternative) across the project area which encompasses about 29,500 acres. The Project would also improve forest health in terms of reducing stand density which would increase stand resistance to insects, disease, and high intensity fires; improve early seral habitat and winter range for deer; improve the fire resiliency in habitat for late-successional dependent species (e.g., northern spotted owl); enhance habitat for the sensitive plant species, *Calochortus persistens* (Siskiyou mariposa lily) which would benefit from reduced shading, competition, and fuel loading in its habitat; and address watershed concerns regarding legacy sediment sites (sites with existing or potential discharge into streams as a result of human activity from the past that can reasonably or feasibly be remedied) in the project area.

The area affected by the proposal is an environment that receives about three fire starts per year. About 80 percent of the project area is moderately or severely departed from historic conditions (fire-return intervals are much longer than historic intervals). Dense brush and dense stands of trees are susceptible to high intensity, stand-replacing wildfire. Mortality in trees is occurring due to dense conditions and to drought. Foraging habitat quality is low for deer, and habitat is limited for late-successional species, also threatened by potential high-intensity wildfire. The habitat for *Calochortus persistens* needs improvement due to increased fuel loading and corresponding risk of fire suppression activities, shading, and competition. There are many legacy sediment sites in the project area, each with different amounts of sediment available to be discharged into streams which would have negative effects on water quality should a discharge event occur.

Action is needed to make the project area more resilient to wildfire and improve the defensibility of areas adjacent to the project area. The Project will address the need to improve stand health and to provide for future sustainable timber yields, the need for improved habitat for early seral and late-successional species, and for improved or maintained habitat for the sensitive plant species, *Calochortus persistens*. It will also address legacy sediment sites as practicable and possible in order to be in compliance with the Clean Water Act.

Public Engagement

See chapter 1 for details. The notice of intent to prepare an environmental impact statement for the Craggy Project was published in the Federal Register on January 4, 2016, beginning a 30-day public scoping period. The Forest used news releases, social media, a public open house, and public field trips to inform broader audiences.

Results of Scoping

The Forest received 122 comments by means of 12 letters or phone calls and one public open house. In response to comments received, the Forest Service determined two issues to be relevant to alternative development or modification. Other issues were also considered during the modification of the proposed action (chapter 2) or addressed in the disposition of scoping comments (available in the Scoping Outcome Summary on the project website).

Relevant issues identified from public scoping and public input are:

1. There was a debate about the effectiveness of the project for adequately protecting private landowners and private property.
2. There was a debate about the environmental effects of project activities such as temporary road construction, timber haul, landing establishment, and yarding activities on soils and aquatic resources.

These issues led the agency to develop alternatives to the proposed action summarized below.

Alternatives Considered in Detail

In response to relevant issues, the Forest Service developed one alternative to the proposed action and three other alternatives were considered but eliminated from detailed study. These are described in detail in chapter 2.

Alternative 1:

This is the no action alternative. Current management plans will continue to guide management of the project area. No project activities would be implemented to accomplish project goals. This alternative provides reviewers a baseline to compare the magnitude of the environmental effects of the action alternatives.

Alternative 2:

This is the proposed action as detailed in the project proposal for scoping with some clarifying additions. The alternative was developed through interdisciplinary involvement and recommendations in order to meet the purpose and need of the project. This alternative proposes treatments on about 10,600 acres; with about 1,400 acres of fuel breaks and roadside fuel treatments, 4,160 acres of prescribed underburning, 900 acres of mastication, 1,330 acres of thinning without removal of forest products and 2,870 acres of thinning with removal of forest products.

Approximately 90 miles of system roads will potentially be used for forest product removal. Two existing low-water crossings have been identified on system roads that may be used in this alternative for forest product removal. To reduce log skidding distances and associated impacts to soils and other resources, 12 miles of existing roadbeds will be used as temporary roads for short-term access. Two miles of new temporary road construction are proposed. All temporary roads on existing roadbeds and new temporary roads will be hydrologically stabilized as described in the project design features (Table 2-1 in chapter 2). Existing landings will be used to the extent possible and all landings will be located in accordance with project design features.

Road-related legacy sediment sites in treatment units and along haul routes that are likely to be used will be treated to minimize the risk to water quality. Some sites may be on unauthorized routes that are closed to public motor vehicle use; these will require survey for heritage resources before implementation can occur. Legacy sediment sites will be treated as agreed upon with the North Coast Regional Water Quality Control Board (Water Board).

Alternative 3:

This was developed in response to the two relevant issues identified during the scoping period: concerns related to hazardous fuels reduction adjacent to private lands; and the

concerns about impacts to watershed condition from implementing proposed activities such as log-haul, road construction, and yarding activities. This alternative proposes treatments on about 11,310 acres, with 2,190 acres of fuel breaks and roadside fuel treatments, 4,430 acres of prescribed underburning, 770 acres of mastication, 1,690 acres of thinning without removal of forest products, and 2,230 acres of thinning with removal of forest products.

Approximately 80 miles of system roads will potentially be used for forest product removal. One existing low-water crossing has been identified on a system road that may be used in this alternative for forest product removal. To reduce log skidding distances and associated impacts to soils and other resources, eleven miles of existing roadbeds will be used as temporary roads for short-term access. One mile of new temporary road construction is proposed. All temporary roads on existing roadbeds and new temporary roads will be hydrologically stabilized as described in the project design features. Existing landings will be used to the extent possible and all landings will be located in accordance with project design features.

Legacy sediment sites will be treated similarly as in Alternative 2 and as agreed upon with the Water Board.

More detailed descriptions of all treatments are provided in chapter 2 and Appendix A of this draft environmental impact statement. Maps of treatment layouts are located in Appendix B. Support documents for this project, including resource reports and maps, are available at the project website: <http://www.fs.usda.gov/project/?project=31770>.

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CHAPTER 1 PURPOSE AND NEED FOR ACTION

1.1 Document Structure

The USDA Forest Service (Forest Service) has prepared this draft environmental impact statement in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This environmental impact statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four chapters:

- *Chapter 1. Purpose and Need for Action:* This chapter briefly describes the proposed action (as presented in public scoping), the existing and desired conditions that drive the need for change, and other purposes to be achieved by the proposal. This section summarizes how the Forest Service informed the public of the proposed action and how the public responded.
- *Chapter 2. Alternatives, including the proposed action:* This chapter provides a detailed description of the agency's modified proposed action as well as alternative actions that were developed in response to comments raised during scoping. The end of the chapter includes a summary table comparing the proposed action and alternatives considered in detail with respect to their environmental impacts.
- *Chapter 3. Affected Environment and Environmental Consequences:* This chapter describes the affected environment and environmental impacts of the proposed action and alternatives.
- *Chapter 4. Preparers, Consultation, Distribution, Glossary, References and Index:* This chapter provides a list of preparers and agencies consulted during the development of the environmental impact statement. Included are a list of acronyms and glossary of terms used, literature cited, and an index of page numbers by document topic.
- *Appendices.* The appendices provide more detailed information to support the analyses presented in the environmental impact statement.

The draft environmental impact statement and supporting documents including maps and resource reports are available on [the Project website](#).

1.2 Background

The Craggy Vegetation Management project (Craggy Project) is located in Siskiyou County, California, about one mile west of Yreka and ten miles north of Fort Jones. The project area encompasses about 29,500 acres, primarily on National Forest System land but including private property within its bounds. Over 75 percent of the project area is in federal ownership with the remainder a mix of industrial forestland and individual, small, privately-owned tracts. Treatments are proposed *only* on land managed by the Klamath National Forest (Forest). Elevation ranges from about 2,000 to 6,200 feet. The legal location is Township (T) 46 North (N), Range (R) 8 West (W), Sections 13, 23-28,

and 32-35; T45N R8W Sections 1-17 and 21-24; T46N R7W, Sections 16-18, 20, 22, 28, 30, and 32-34; and T45N R7W, Sections 4-6, 8, 9, and 17-20 (Mt. Diablo Meridian).

The project area is primarily located within eight 7th field watersheds¹ (Clear Creek, Upper Humbug Creek, Lower Humbug Creek, Middle Fork Humbug Creek, Greenhorn Creek, Yreka City-Yreka Creek, Rocky Gulch-Yreka Creek, and Long Gulch). These are within the Yreka Creek and Humbug Creek 6th field watersheds, and within the Yreka Creek-Shasta River and Humbug Creek-Klamath River 5th field watersheds. Along with a small portion of the Klamath River, several connected fish-bearing streams are within the analysis area: Humbug Creek, Middle Fork Humbug Creek, South Fork Humbug Creek, and Sucker Creek.

The majority of the project area, except for the easternmost 25 percent, is within the footprint of the 1955 Haystack Fire. In response to this fire, salvage logging occurred followed by multiple reforestation efforts at different times (for more information see the full silviculture (vegetation) report available on the project website). There are also stands where residual conifers provided natural seeding and reforestation. The result of years of conifer reforestation efforts is that the majority of the project area is dominated by relatively young, pole- to small-sized conifers. Other than these reforestation efforts, few management activities have occurred within the Craggy project area, other than minimal amounts of fuel reduction and thinning (see the silviculture and fire and fuels reports), leaving the area with dense stands of trees and brush.

Common conifer species found in the project area are ponderosa and Jeffrey pine, Douglas-fir, sugar pine, white fir, and incense cedar. There is also a well-established brush and hardwood component in many areas. The ecological diversity found throughout the Klamath Province is reflected in the diversity of vegetation types and terrain in the Craggy project area. Diversity of vegetation may exist over the project area as a whole, but conditions within stands are mostly homogeneous.

The composition of riparian vegetation within the project area is very diverse, reflecting differences between locations in regard to elevation, slope aspect, soil character, timber harvest, wildfire history, and local hydrologic condition. Large-scale scouring by recent floods, especially from 1964 and 1997 (see the full aquatic resources report on the project website), has reset the riparian vegetation to an early- to mid-seral progression in many tributaries with regrowth inhibited due to banks being reduced to cobbles and other coarse materials. Alder, big-leaf maple, cottonwood, willow, and dogwood are common riparian species. Drier areas within the riparian area may also include upland species such as oak, Douglas-fir, incense cedar, and other conifers mentioned above.

¹ The Cayuse Gulch-Klamath River, Modoc Gulch-Shasta River, Cherry Creek, Deadwood Creek, Badger Creek-Klamath River, Little Humbug Creek, Miller Gulch-Klamath River, Grouse Creek, and Vesa Creek 7th field watersheds are slightly within the Craggy project boundary, but total less than one percent of the project area. Please see the 7th field watershed map in Appendix B for a visual representation of this.

Existing Condition

The existing condition of the project area is as follows:

Defensibility and Resiliency to Wildfires

The project area is within the wildfire threat zone of the town of Yreka, a municipality identified by the 2001 National Fire Plan as an at-risk-community to wildfire (a list of such communities in California is found on the California Department of Forestry and Fire Protection (CALFIRE) website (<http://www.fire.ca.gov/>). About three fire starts per year occur within the project area with historic fire-return intervals of 11 to 55 years. About 80 percent of the project area is moderately to severely departed from historic conditions (fire-return intervals are much longer than historic intervals). The project area is located in an area that can receive a high concentration of lightning strikes.

The effects of past harvest, overstocking, fuels accumulations, large amounts of decadent brush, insects, diseases, drought, mortality, and fire suppression has put this area at substantial risk to severe wildfire. Nearly 90 percent of the project area has been fire-free since 1955. As a result, the build-up of ladder and surface fuels has increased the probability of high-severity stand-replacing fire.

Current fire modeling predicts that, during extreme fire weather conditions (90th percentile weather conditions), only 18 percent of the project area will have flame lengths of less than four feet, which is the height that flames should be below to provide for more safe and direct attack. There exists potential to threaten resource values such as wildlife and botanical habitat, soil stability, human uses, hydrology, air quality, and more. This threat increases as the potential flame length increases.

Forest Health

The project area includes highly-stocked and mostly homogeneous plantation stands that are reaching 60 to 80 percent of the maximum carrying capacity. Ongoing mortality is especially noticeable in the pine plantations and on the drier south and west facing slopes. A limited number of natural stands exist; these are also suffering from high tree mortality due to high stocking levels added to the effects of drought. The current stand densities are not sustainable and stands are facing ongoing mortality due to the factors mentioned above.

Homogeneity in plantations is also contributing to negative effects from insects and disease. Mistletoe infections are increasing and western pine beetles have begun killing small (less than a quarter acre) groups of trees with increasing frequency over the last five years in the older planted stands and terraced plantations.

Current densities, fuel accumulations, and the effects of insects and disease would contribute to increased potential effects from another wildfire, should one occur in the area.

Early seral Habitat

Foraging habitat for early seral wildlife species such as deer is at a low level and animal access through brush and dense tree stands is below optimal conditions. Winter range for deer is lacking due to the increasing decadence in brush and hardwood stands. Early seral habitat quality is low to moderate and deer populations are low.

Late-successional Habitat

Habitat for species dependent on late-successional stand characteristics (such as northern spotted owl and fisher) is limited and likely to be reduced due to high-intensity wildfires. Other existing factors that may detract from late-successional habitat are the over-stocked densities of many stands in the project area, that can contribute to the likelihood of increased insect and disease mortality in trees within or adjacent to the habitat needed for late-successional species. Many of the stands are dominated by small diameter conifers but contain scattered legacy trees exceeding 30 inches in diameter (e.g. large hardwoods and large Douglas-fir trees) that are important to northern spotted owl for their prey base.

Sensitive Plant Species Habitat

Calochortus persistens has been reviewed as a candidate for federal listing by the U.S. Fish and Wildlife Service. The candidate listing designation was removed following this review allowing for continued management as a Forest Service Sensitive species provided that a conservation agreement was developed and implemented for the species. As a result the Conservation Agreement between the U.S. Fish and Wildlife Service and the U.S. Forest Service and U.S. Bureau of Land Management for *Calochortus persistens* (Siskiyou mariposa lily) (USDI USDA 2013) was developed that outlines management tasks that will reduce the known threats to the species. Two of these management tasks are as follows:

- If encroachment appears to be occurring, plan and conduct prescribed burn tests or small conifer hand-removal projects in those areas.
- Plan and implement fuel reduction test plots within portions of *C. persistens* habitat that will reduce the risk of high-intensity fire, shading, and competition. Continue prescribed burning if tests show it creates suitable habitat that is being colonized by *C. persistens* plants. Discontinue prescribed fire if tests show that this type of disturbance increases the density of *Isatis tinctoria* or other weeds.

The population of *Calochortus persistens* within the project area is scattered along a six-mile stretch of ridgetop within a montane shrub plant community of rocky openings on both Forest and private land. Surrounding the open shrubby vegetative community where *Calochortus persistens* occurs is mixed coniferous forest. Populations of *Calochortus persistens* within the project area are currently viable and static. However, encroachment is on-going and has resulted in increased fuel loading, shading, competition, the risk of high intensity wildfire, and the potential risk of fire suppression activities that could be destructive to its habitat.

A non-native invasive plant, Dyer's woad or Marlahan mustard (*Isatis tinctoria*), occurs on the ridge within *Calochortus persistens* habitat. Past and ongoing annual management efforts have reduced this infestation in some locations along the ridge, but its competition with *Calochortus persistens* is considered a primary threat to this population.

Eriogonum ursinum var. *erubescens* is another Forest Service Sensitive plant species present within the project area. Habitat where this species occurs in the project area is currently within desired conditions, project design features have been developed to

reduce project related effects to this species (Table 2-1); effects to this species are discussed in the botany section of chapter 3.

Legacy Sediment Sites

Current conditions do not meet water quality standards; streams in the project area are listed as impaired under section 303(d) of the Clean Water Act. Due to past storm events, activities, and highly erosive granitic soils that occur in the project area, some segments of the road system (legacy sediment sites) are not resilient to disturbance by fire and floods which may cause soil erosion or trigger debris torrents that remove riparian vegetation, reduce stream shade and increase water temperatures.

Desired Condition

The Forest Plan (USDA 1995, as amended), which incorporates the Northwest Forest Plan, provides direction for projects such as the Craggy Vegetation Management Project. The Humbug Landscape Analysis and Design is an assessment document that provides a means by which the landscape can be understood as an ecological system, and knowledge to help shape the landscape patterns created through National Forest land management activities (USDA 1993). Both documents describe desired conditions for the Forest and for management areas within the Humbug landscape. The analysis and design document provides specific desired conditions in terms of stand densities, stand structure, landscape elements, and in terms of percentage of area within the landscape. The range of desired conditions, along with individual element descriptions, is designed to be consistent with landscape scale processes, provide a variety of habitat values, provide a variety of opportunities for human uses, and provide sustainable and predictable levels of resource outputs (USDA 1993).

The desired condition for the project area is the following:

Defensibility and Resiliency to Wildfires

The project area moves toward more frequent fire-return levels and lower intensity wildfires. Less intense fires will occur where the fire stays on the surface of the land and out of the tree crowns, with flame lengths of less than four feet in height, particularly in the defense zone around communities. Less intense fires will allow for direct attack by firefighters using hand tools and will bring the area to a level conducive to protect communities by providing for safe and effective firefighting.

Diverse vegetation conditions that do not promote high-severity wildfire are present and the area is more fire-resilient. Due to fire characteristics on different aspects and slope positions, south and west slopes and upper slope positions would be more open due to more frequent and intense fire regimes while north and east slopes and lower slope positions would have denser vegetation relative to drier sites.

Forest Health

Stand health is improved and maintained; stands are resilient to wildfire and tree mortality from insect and disease infestations. A diversity of tree species within stands is encouraged where the site is capable of supporting diverse species, including hardwoods and conifers. Conifer growth and stocking levels provide future sustainable timber yields. Stand health will increase due to decreased densities and competition. Planted

areas have returned to more natural, open conditions. Natural stands have in-growth from fire suppression removed, more open understories, and heterogeneity of crown structure.

Early Seral Habitat

Early seral habitat is promoted through creation of a mosaic of conditions across the landscape. Diversity of brush age classes increases as natural disturbance regimes such as low intensity fire encourage new growth on brush. Leave islands and irregular edges maintain vegetation structure suitable for species that prefer more open habitat and habitat for early seral species. Encroachment by small conifers is reduced; in oak stands and areas with springs, foraging habitat for wildlife species dependent on early seral habitat is abundant.

Late-successional Habitat

In late-successional habitat in the long term, decreased densities of stands and increased tree species diversity will increase resilience to disturbance from wildfire, insects, and disease outbreaks. Habitat for species dependent on late-successional habitat will increase in amount and quality.

Sensitive Plant Species Habitat

Random natural variation within the habitat for *Calochortus persistens* will occur without negative effects on the future viability of the species. Occupied *Calochortus persistens* habitat will be open with reduced levels of conifer and brush encroachment and a shallow or absent litter and duff layer. The conifer stands surrounding this population will be less susceptible to high intensity wildfire and more likely to support lower intensity mosaic burn conditions than at present. Reduced flame lengths in the stands surrounding this habitat could be low enough that suppression is feasible with hand tools rather than heavy equipment. *Isatis tinctoria* (Dyer's woad or Marlahan mustard), a non-native invasive species, will not spread beyond current infestation boundaries.

Legacy Sediment Sites

Potential discharge of sediment to streams is reduced from the current condition. Potential sediment sources are inventoried and assessed for potential risk of sedimentation. Untreated road sediment sources (legacy sites) do not pose substantial risks of material entering stream courses.

1.3 Management Direction

Direction for this project comes from the Forest Plan. Direction in the Forest Plan is provided for the Forest as a whole in forest-wide management goals, standards and guidelines. Direction is also provided specifically for management areas (MAs). Management areas within the project area are: MA-5 Special Habitat (*Calochortus persistens*), MA-5 Special Habitat (Late Successional Reserve), MA-10 Riparian Reserves, MA-11 Retention Visual Quality Objective (VQO), MA-15 Partial Retention Visual Quality Objective, and MA-17 General Forest. Of these land allocations, all except for riparian reserves are mutually exclusive; riparian reserves may overlap other

management areas so the total number of acres in the project area is less than the sum of the acres in various land allocations.

Most of the land allocations within the project area include goals to provide a programmed, sustained harvest of wood products; provide habitat for wildlife and fish; and protect sensitive plants, water quality, and scenery. Relevant goals for each management area in the project area are listed in Table 1-1.

Table 1-1: Relevant Forest Plan Goals per Management Area in Project Area

Management Area	Acres ²	% of project area	Forest Plan (pages)	Goals Pertinent to This Proposal
Special Habitat, <i>Calochortus persistens</i> (MA 5)	940	4	4-94	Maintain the currently known, and any newly discovered, <i>Calochortus</i> population's habitat in an undisturbed condition. Inventory similar habitats for potential population expansion opportunities. Manage habitat to provide for a viable population of <i>Calochortus</i> . Manage the plant populations and species vigor in a way that would prevent the need to list this species as threatened and endangered. Reduce or eliminate invasive, non-native weedy plant species that compete with <i>Calochortus</i> for water, space and nutrients.
Special Habitat, Late Successional Reserve (MA 5)	110	<1	4-83 to 4-89	Protect and enhance conditions of late-successional and "old growth" forest ecosystems, which serve as habitat for late-successional and "old growth"-related species, including the northern spotted owl.
Riparian Reserves (MA 10)	6,250	21	4-106 to 4-114	Maintain and restore riparian-dependent structures and functions of intermittent streams. Be consistent with Aquatic Conservation Strategy goals.
Retention Visual Quality Objective (MA 11)	10	<1	4-115 to 4-116	Manage for a programmed, sustained harvest of wood products in area that are capable, available, and suitable for timber management. Maintain stand health, as well as resilience to wildland fire, insect, disease, and other damage. Provide a level of attractive, forested scenery by maintaining the areas in a natural or natural-appearing condition.
Partial Retention Visual Quality Objective (MA 15)	6,650	22	4-126 to 4-127	Manage for a sustained yield of wood products in areas capable, available, and suitable for timber production. Maintain stand health as well as resilience to wildland fire, insect, disease, and other damage. Provide an attractive, forested landscape where management activities remain visually subordinate to the character of the landscape.

² Acres for management areas listed here are updated from what was reported in the Craggy Project Proposal. Updates occurred within the geographic information system (GIS) database in order to more accurately portray the distribution of management areas, and to include the updated designations of lands acquired since the Forest Plan (see page 4-41 of the Forest Plan for guidance on this direction).

Management Area	Acres ²	% of project area	Forest Plan (pages)	Goals Pertinent to This Proposal
General Forest (MA 17)	9,480	31	4-131 to 4-132	Provide a programmed, non-declining flow of timber products, sustainable through time. Maintain conifer stocking levels and high growth rates commensurate with the capability of the site to produce wood fiber. Intensively manage young regenerated stands to maximize growth potential. Maintain stand health, resilience to wildland fire, insect, disease, and other damage. Emulate ecological processes and stand and landscape patterns where possible. Within harvest units, maintain appropriate structure, composition, and ecological functioning of the area. Provide for snags and hardwood habitat to help maintain viable populations of wildlife species that require these structural components. Meet the VQOs. Achieve less modified visual conditions when possible.

Forest-wide standards and guidelines that are pertinent to this project, and the ways in which the project is consistent with this direction, are included in the Forest Plan Consistency Checklist, available on the project website. For further information pertaining to the Forest Plan, please visit the Forest website:

<http://www.fs.usda.gov/main/klamath/landmanagement/planning>.

The project is in compliance with the Forest Plan. No site-specific amendments to the Forest Plan are required. Assessments that provide background information for this project include the Humbug Landscape Analysis and Design (1993), and the Forest-wide Late Successional Reserve Assessment (USDA 1999, page 2-91). Assessment documents are available at:

<http://www.fs.usda.gov/detail/klamath/landmanagement/planning/?cid=STELPRDB5109804>.

1.4 Purpose and Need for Action

The purpose of the Craggy Project is to reduce the gap between existing and desired conditions. There is a need for defensibility and resiliency to wildfires; to improve forest health; to improve early-seral, late-successional, and sensitive plant species habitat; and to reduce sedimentation of streams by addressing legacy sediment sites.

- **Defensibility and Resiliency to Wildfire:** The threat of high-intensity wildfire moving toward the communities of Yreka, Hawkinsville, Humbug, and residences in the Greenhorn area is exacerbated by the recent years of drought and heavy fuels in the project area due to past fire suppression and resulting growth of brush and dense stands of trees. There is a need to reduce fuel loading within the project area to improve defensibility and resiliency to wildfire.
- **Forest Health:** A high level of stand density has led to a project area that is not resilient to insects, disease, and high-intensity, stand-replacing wildfire. There is a need to reduce stand density in both plantations and natural stands.
- **Early Seral and Late-Successional Habitat:** Foraging habitat for wildlife species dependent on early seral vegetation (grasses, shrubs and forbs) is lacking and is dominated by decadent chaparral habitat. Access through brush and dense stands is below optimal conditions. The deer populations have subsequently

decreased in the general area. There is an opportunity to increase forage habitat availability in the project area. This area is popular for local hunter use. Additionally, habitat for late-successional species such as northern spotted owl needs to be improved and maintained in the long-term. Late-successional forested habitat is limited due to past harvesting, historic wildfires, and ecological types existing in the area. Existing conditions are on a trajectory for a continued decrease in these habitat conditions. Late-successional habitat is in jeopardy of loss to wildfire due to overstocked stands and high fuel loadings. There is a need to provide for improved mosaic habitat diversity, promote late-successional habitat, and reduce the risk of the loss of these habitats to wildfire.

- **Sensitive Plant Species Habitat:** There is a need to address known and potential threats to *Calochortus persistens* to maintain populations so that random natural variation can occur without a negative effect on the future viability of the species. Threats include conifer and shrub encroachment that result in fuel loading, shading, and competition; competition from non-native and invasive plant species; and high-intensity wildfires and fire suppression activities that can affect populations negatively.
- **Legacy Sediment Sites:** Direct discharge of sediment to streams during storms has negative effects on water quality that need to be addressed to be in compliance with the Clean Water Act.

1.5 Proposed Action

The proposed action, as documented in the scoping notice for the project, was designed to meet the purpose and need of the project by treating about 10,600 acres of the 29,500-acre project area. Acres by treatment type are described below and do not account for the overlap in treatment types.

Craggy, as described in the scoping notice issued in January 4, 2016, includes five overlapping types of treatment: (1) fuel breaks and roadside fuel treatments on about 1,400 acres; (2) prescribed underburning on about 4,160 acres; (3) mastication on about 900 acres; (4) thinning without removal of forest products on about 1,330 acres; (5) thinning with removal of forest products on about 2,870 acres.

Sixty-eight legacy sediment sites were proposed for treatment to improve water quality. The proposed action includes the use of 12 miles of temporary road on existing roadbeds and construction of about two miles of new temporary roads. Ninety miles of system roads will potentially be used for forest product removal. No roads will be added to or deleted from the National Forest Transportation System. Existing landings will be used to the extent possible.

To address public scoping comments and correct errors, the proposed action was modified. This modified proposed action is analyzed as Alternative 2 in this draft environmental impact statement and includes slight modifications due to edited geospatial information.

To address public scoping comments and correct errors, the proposed action was modified as follows to become Alternative 2:

- One proposed treatment unit (136-61) for thinning of small material was modified to remove 61 acres of the unit that are on a slope position that has a low susceptibility to high-intensity wildfire within a 100-acre late successional reserve and within foraging habitat in a historical northern spotted owl home range. The 57 acres left in the treatment unit are part of the upper one-third slope position on which thinning will decrease the potential for development of crown fires within the unit.
- The set of legacy sediment sites proposed for treatment has been modified due to a recent inventory of sites and new evaluation of the water quality risk. The modified set of legacy sediment sites is based on optimizing the treatment of sites with the greatest potential risk for failure and the highest hazard or volume of potential sediment entering waterways. The final list of sediment sites to be treated will be based on agreement with the Water Board to meet the requirements of the 2015 Waiver of Waste Discharge Requirements for Nonpoint Source Discharges Related to Certain Federal Land Management Activities on National Forest System Lands in the North Coast Region (Waiver).
- Minor modifications are made due to edited geospatial information.

1.6 Decision Framework

The Forest Supervisor is the responsible official for Craggy. After the Forest receives comments on this draft environmental impact statement, a final environmental impact statement and draft record of decision will be prepared and distributed. There will be a 45-day time period to raise objections to the final environmental impact statement and draft record of decision followed by a time period for objection resolution prior to the final record of decision. Within the final record of decision, the responsible official will decide whether to implement the modified proposed action, an alternative to the proposed action, or choose no action. The final decision will be based on the information in the final environmental impact statement and the supporting information contained in the project record, consideration of public comments, how well the selected alternative meets the purpose and need for the project, and whether the selected alternative complies with agency policy, applicable state and federal laws, and Forest Plan direction.

1.7 Public Involvement

Planning for this project was initiated in 2010. The project was first published to the Schedule of Proposed Actions and the Forest website on April 1, 2010.

Public involvement with the Yreka Area Fire Safe Council and Klamath Siskiyou Wildlands Center began in 2012. This outreach effort led to public field trips in 2012 and 2013. Comments were sought from a number of other organizations and Indian tribes; those providing input during this process included the City of Yreka, California Department of Forestry and Fire Protection (CALFIRE), U.S. Fish and Wildlife Service, Shasta Tribe Inc., California Deer Association, and the Office of the State Senator for the area including the project.

Scoping was originally planned for spring 2014 but was delayed due to agency personnel changes and the reprioritization of resources in response to large-scale wildfires in 2013 and 2014. On December 30, 2015, a scoping letter was sent to interested and affected parties, including the Environmental Protection Agency, Quartz Valley Indian Reservation, Karuk Tribe, Shasta Indian Nation, Shasta Nation Inc., adjacent property owners, and other interested groups and individuals. The list of addresses of landowners was sourced from the Siskiyou County Assessor's Office tax-payer records. On January 4, 2016, a legal notice of scoping was published in the Siskiyou Daily News, the newspaper of record for the project. Project information including the project proposal and maps were made available on [the Project website](#), and a notice of intent to prepare an environmental impact statement for the project was published in the Federal Register on the same date; this notice began the formal scoping process that guides the development of the environmental impact statement.

The Forest and Yreka Area Fire Safe Council co-sponsored an open house on January 13, 2016. This open house was attended by representatives from the City of Yreka, CALFIRE, Northern California Resource Center, Siskiyou Gardens, Parks and Greenway Association, and landowners within and adjacent to the project area as well as other private individuals. A total of 17 participants signed the attendance sheet. CALFIRE representatives and private individuals were especially interested in fuels reduction treatments adjacent to private lands and proposed additional areas for treatment. Subsequently on March 1, 2016, the project team leader and fire and fuels specialist met with CALFIRE to further discuss the agency's interests and potential modification of the proposed action. This led to the development of Alternative B, which includes additional fuels reduction treatments.

The comments received as a result of public scoping are summarized in the scoping outcome summary, available on [the Project website](#). The interdisciplinary team met and reviewed the scoping responses on March 9, 2016. This meeting included representatives from National Marine Fisheries Service and U.S. Fish and Wildlife Service. Ideas presented at the meeting led to clarification of the proposed action and were considered in the development of alternatives. Consultation with the U.S. Fish and Wildlife Service and National Marine Fisheries Service is ongoing.

1.8 Issues

Following public scoping, comments were categorized as either concerns or issues.

Concerns are general comments or questions that do not meet the definition of an issue.

Issues are defined as points of discussion, dispute, or debate about the environmental effects that may directly or indirectly be caused by implementing the proposed action, and are categorized as follows:

Relevant issues are issues that led to development of alternatives or project design features not previously identified in the project proposal.

Other Issues are issues that may not be relevant for alternative or project design feature development for any of the following reasons: (1) the issue was outside the scope of the proposed action, and is not related to the decision to be made; (2) the issue is already decided by law, regulation, policy, or direction (Forest Plan); (3) the issue was addressed

through project design features in the project proposal or was (or will be) addressed through analysis; or (4) the issue is not supported by scientific (or factual) evidence.

The Forest received 122 comments by means of twelve letters or phone calls and one public open house. During scoping, 58 issues or concerns were identified, and two issues were identified and determined to be relevant to alternative development or modification (Table 1-2).

Table 1-2: Relevant Issues Identified for this Project and their Associated Indicators

Relevant Issues and their Indicators	Descriptions
Relevant Issue #1:	There is a point of discussion about the effectiveness of the project for adequately protecting private landowners and private property.
Indicators:	Potential flame length in wildland-urban interface defense zones. Acres treated adjacent to private land.
Relevant Issue #2:	There is a point of discussion about the environmental effects of project activities such as temporary road construction, timber haul, landing establishment, and yarding activities on soils and aquatic resources.
Indicators:	Cumulative watershed effects results (equivalent roaded area, landslide potential, and soil erosion). Miles of temporary roads. Miles of road (all types) used for forest product removal. Number of low-water stream crossings. Number of new landings. Potential hazard reduction from treatment of legacy sediment sites.

Other issues were raised by the public that were either addressed in *alternatives considered but eliminated from detailed study* (see chapter 2 for reasons detailing these eliminations) or are included in the analysis in this document. See the scoping outcome summary on the project website for a discussion of the way comments to the project proposal are treated.

CHAPTER 2 ALTERNATIVES, INCLUDING THE PROPOSED ACTION

This chapter describes and compares the alternatives considered for the Craggy Project. This chapter includes a description of each alternative considered in detail. It also includes alternatives considered but eliminated from detailed study and the reason for their elimination. Maps of each action alternative considered in detail are available in Appendix B.

This chapter also presents the alternatives considered in detail in comparative form, defining the differences between alternatives and providing a clear basis for choice among options by the decision maker and the public.

The interdisciplinary team developed the proposed action (Alternative 2) to respond to the purpose and need of the project. Alternative 3 responds to public comments received from the project proposal scoping.

A “no action” alternative (Alternative 1), required by the Council on Environmental Quality NEPA regulations (40 CFR 1502.14 (d)), is analyzed to provide a baseline for consideration of the effects of the proposed action and other action alternatives. Three additional alternatives responding to public comment are considered but eliminated from detailed study for reasons cited later in this chapter.

2.1 Alternatives Considered in Detail

Alternative 1

Under this alternative, current management plans continue to guide management of the project area. No project activities would be implemented to accomplish project goals. This alternative provides reviewers a baseline to compare the magnitude of the environmental effects of the action alternatives.

Alternative 2

Alternative 2 is the proposed action as detailed in the project proposal for scoping with some clarifying additions. About 10,600 acres are proposed for treatment with this alternative. Actions in this alternative are as follows:

Fuel Breaks and Roadside Fuel Treatments (1,400 acres): Fuel breaks would be placed along key ridges in the project area. The *ridgeline* fuel breaks would be generally about 300 feet in width, but may be more in order to strategically tie into other fuel breaks along a road. Within these fuel breaks, conifers less than 10 inches in diameter would be thinned manually, hand-piled, and burned. Variable density thinning (thinning focused on leaving a variety of spacing and structure rather than a uniform approach) would be used to obtain an average spacing ranging from 20 to 25 feet for both conifers and hardwoods (see the silviculture resource report and chapter 3 for more information). Areas dominated by brush would also be hand-cut, piled, and burned. Actual treatment areas would vary in size according to field conditions.

Fuelbreaks adjacent to *private land* are the same as ridgeline fuelbreaks in their manner of treatment methods. Their width would be up to 150 feet. Actual treatment areas would vary in size according to field conditions.

In *roadside* fuel treatments, brush and small diameter trees (less than 10 inches in diameter) would be manually cut, hand-piled and burned. Where equipment can remove trees without leaving an established roadbed, some trees may be removed as biomass where this removal would support achieving the desired conditions. Residual trees would be limbed up to seven feet in height. Actual treatment areas may vary in size and width depending on fuel conditions but would not exceed 300 feet (150 feet on either side of the road). Trees less than 10 inches in diameter would be variable-density thinned to the average spacing mentioned above for *ridgeline* fuelbreaks. Areas dominated by brush would be hand cut, piled, and burned. Fuels reduction and removal of encroaching brush using hand-cutting and piling, may occur through two subpopulations of *Calochortus persistens* as described in the project design features.

Prescribed Underburning (4,160 acres): In the project area, strategic areas would be underburned according to an approved burn plan. All prescribed fire operations would be conducted subject to an administratively approved burn plan which includes the objectives of the burn, desired fire behavior and intensity, an emergency contingency plan, and specified level of response to a fire escape. Prescribed fire effects in riparian reserves would be designed to mimic a low intensity backing fire, except for hand-piles where higher intensity may occur to consume pile material. In upland areas, fire effects would be designed to range from low to moderate with consumption of primarily litter and fine woody debris. Prescribed underburning may be used in the *Calochortus persistens* Management Area (part of the Forest Plan Management Area 5) in accordance with the project design features. All burning within this area would be done in coordination with the project botanist and timed during the dormant growing season.

Mastication (900 acres): In the project area, mastication would be used in areas that are dominated by decadent brush. Operation of mastication equipment would be in accordance with project design features.

Thinning without Removal of Forest Products³ (1,270 acres): Conifers less than 10 inches in diameter would be hand-thinned using a variable-density approach designed to leave the more desirable trees. Cut trees would be limbed and bucked with resulting slash scattered or hand-piled for burning.

Thinning with Removal of Forest Products⁴ (2,870 acres): Both ground-based and skyline cable yarding systems would be used to yard thinned trees. Trees would be thinned by a combination of hand and mechanical falling using a variable-density thinning approach. Ground-based yarding is proposed for 1,730 acres of which 1,260 are in plantations. Cable

³ This activity is sometimes referred to as “non-commercial thinning.” For the purposes of environmental analysis, the description of this treatment (size of trees to be thinned and method used) is more important than the name.

⁴ In some documents, this is referred to as “commercial thinning.” Except for economic impacts, the environmental effects of this treatment are not dependent on whether or not the products are sold but by the size and methods used to remove the products.

yarding is planned for 1,140 acres of which 510 are in plantations; of this cable yarding, 60 acres are proposed for endline yarding and 1,080 for skyline cable yarding. Areas planned for cable yarding may instead be treated using tethered harvesting equipment. Trees brought to a landing would be either merchandized into round log products and transported to a mill for making into lumber or veneer forest products, chipped, or piled for disposal by burning. Activity-generated fuels would be treated by hand piling, machine piling, whole-tree yarding, or underburning.

Access and Roads: No roads would be added to, or removed from, the National Forest Transportation System (system) as part of this project. Ninety miles of system roads would potentially be used for forest product removal. Two existing low-water crossings have been identified on system roads that may be used in this alternative for forest product removal. To reduce log skidding distances and associated impacts to soils and other resources, 12 miles of existing roadbeds would be used as temporary roads for short-term access. Two miles of new temporary road construction are proposed. All temporary roads on existing roadbeds and new temporary roads would be hydrologically stabilized as described in the project design features. Existing landings would be used to the extent possible and all landings would be located in accordance with project design features.

Legacy Sediment Site Restoration: Road-related legacy sediment sites in treatment units and along haul routes that are likely to be used would be treated to minimize the risk to water quality. Some sites may be on unauthorized routes that are closed to public motor vehicle use; these would require survey for resources of concern including heritage resources before implementation can occur. Legacy sediment sites would be treated as agreed upon with the Water Board. Any or all of the following legacy site restoration activities may be carried out as appropriate for a given site:

- Remove fill from streambanks and unstable areas
- Construct dips at stream crossings to eliminate diversion potential
- Outslope road surface and eliminate in-board ditch or outside berms
- Seed, mulch, or plant disturbed areas to control surface erosion
- Stabilize landslides. May include construction of retaining walls
- Upgrade culverts to pass 100-year peak flows
- Reduce road fill volumes at stream crossings to withstand 100-year peak flows and debris flows
- Apply rock aggregate to the road surface

Alternative 3

Alternative 3 was developed in response to the two relevant issues identified during the scoping period: concerns related to hazardous fuels reduction adjacent to private lands; and the concerns about impacts to watershed condition from implementing proposed activities such as log-haul, road construction, and yarding activities. As a result, about 11,310 total acres of treatment are proposed in Alternative 3; changes from Alternative 2 are summarized below and the location of the modifications are provided on the map of Alternative 3 in Appendix B:

- Hazardous fuel reduction treatments adjacent to private lands (fuelbreaks and underburning) have been modified to increase protection in response to comments received from private individuals and fire protection agency recommendations. This includes changing some units from mastication to fuelbreaks and increasing the width of fuelbreaks adjacent to private property (up to 300 feet wide). This results in 2,190 acres of fuel break treatments, 760 acres of mastication, and 4,430 acres of underburning; in total.
- Change of some units from thinning with forest product removal to thinning without removal. This change reduces the number of low-water stream crossings and miles of road likely to be used for transportation of forest products. Resulting in about 1,690 acres of thinning without removal of forest products and thinning with removal of forest products on about 2,230 acres. Ground-based yarding is proposed for 1,170 acres of which 620 are in plantations. Cable yarding or tethered harvesting equipment is planned for 1,060 acres of which 310 are in plantations; of this cable yarding, 60 acres are proposed for endline yarding and 1,000 for skyline cable yarding.
- Access and roads (one mile of new temporary road, 11 miles of temporary road on existing roadbeds, 80 miles of road that potentially may be used for forest product removal, and one low-water crossing on a system road that may be used in the project).
- Unit 136-61 was modified in response to conversations with representatives of the U.S. Fish and Wildlife Service. The unit boundary was modified to decrease impacts to northern spotted owl foraging habitat from proposed treatment activities.

2.2 Project Design Features Applicable to All Alternatives

Project design features specific to this project, developed prior to and after scoping, will be used as a part of all action alternatives to minimize or eliminate negative effects to resources in the project area. Implementing these project design features helps ensure compliance with the Forest Plan and applicable laws and regulations. Specific best management practices that will be followed are listed in Appendix D of this document. Interim riparian reserve widths from the Forest Plan are used for this project because these are determined to be sufficient for resource protection in the project area.

Project design features in the following table are listed under the resource for which they are intended to reduce effects. They are applicable to units and alternatives in which these units are being treated. “All alternatives” in this table refers to all action alternatives.

Table 2-1: Project Design Features

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Air Quality-1	Haul routes will be watered to suppress dust when needed.	<u>All Alternatives</u> ; All Forest Service Roads in project area	National Core BMP Road-4 (R5 BMP 2.4); required for Water Board Waiver

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Botany-1	Within <i>Calochortus persistens</i> habitat (in the <i>Calochortus persistens</i> management area, ground disturbance will only occur within designated unit boundaries; all equipment and project related disturbance will not operate or occur outside those boundaries except on designated road systems. No new landings will be constructed within this management area. Use of existing landings will be coordinated with the district botanist.	<u>All Alternatives:</u> Units 134-47S, 138-155S, 138-46E, 138-56S, 138-71S, 544-17S, 544-19S, 544-20E, 544-222S	USFWS / USFS / Bureau of Land Management (BLM) Conservation Agreement
Botany-2	Within <i>Calochortus persistens</i> populations in the <i>Calochortus persistens</i> management area, all sub-populations within the project area will be flagged. No equipment/vehicle activity, tree skidding, or any other form of ground disturbance will occur within these flagged boundaries. Burn piles will not be constructed within flagged areas.	<u>All Alternatives:</u> Units 134-47S, 138-155S, 138-46E, 138-56S, 138-71S, 544-17S, 544-19S, 544-20E, 544-222S, 134-70P, 138-102P, 138-56P, 138-70P, FBP1, FBR2, FBS1, FBS2	USFWS / USFS / BLM Conservation Agreement
Botany-3	Two sub-populations of <i>Calochortus persistens</i> will be included for fuels removal treatment and underburn prescriptions. This work will be implemented with the district botanist and the following design features will be implemented: 1) Prescribed fire, and removal of brush and small diameter conifers within the sub-population boundary will only occur outside of the active growing season (April through August); 2) Burn piles will not be constructed within the flagged population boundaries; 3) Monitoring will occur after implementation and will include monitoring non-native invasive plant species.	<u>All Alternatives:</u> UB5, FBR2, and FBS1	USFWS / USFS / BLM Conservation Agreement
Botany-4	All populations of <i>Eriogonum ursinum</i> var. <i>erubescens</i> within the project area will be excluded from all project activities. These locations will be flagged with yellow and black flagging prior to project implementation.	<u>All Alternatives:</u> UB1, UB5, FBR2, FBS1, 138-155	USFWS / USFS / BLM Conservation Agreement
Fuels-1	All prescribed fire operations will be conducted subject to an administratively approved burn plan which includes the objectives of the burn, desired fire behavior and intensity, an emergency contingency plan and specified level of response to a fire escape.	<u>All Alternatives:</u> Units UB1, UB2, UB3, UB4, UB5	Forest Plan S&G 22-10; Response to Comments

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Fuels-2	<p>The prescribed burn plan will include a smoke management plan with the following features:</p> <ul style="list-style-type: none"> * Burning will be implemented when smoke is likely to be transported away from sensitive locations, when possible. * Residents and landowners likely to be affected by smoke will be notified, as appropriate, prior to ignition. * Ignition will only take place on permissive burn days as determined by the Siskiyou County Air Pollution Control District. * Forecasts of weather in the project area will be used to ensure favorable “within prescription” weather conditions for the burn and smoke transport. Contingency plans will be developed to minimize smoke impacts if meteorological conditions change. 	<p><u>All Alternatives:</u> All underburn, fuel break, and thinning units</p>	<p>Forest-wide S&G 22-21</p>
Heritage-1	<p>All heritage sites within the area of potential effects will be clearly delineated prior to implementation. This includes but is not limited to flagging site boundaries.</p>	<p><u>All Alternatives:</u> All Units</p>	<p>Forest Plan S&G 24-7</p>
Heritage-2	<p>In the event that new heritage resources are discovered during project implementation, the district archaeologist and/or heritage program manager must be notified and all activities in the immediate vicinity of the resource shall cease until site evaluation is completed.</p>	<p><u>All Alternatives:</u> All Units</p>	<p>Forest Plan S&G 24-7</p>
Invasive Species-1	<p>Equipment and vehicles that leave established road surfaces will be cleaned of soil, seeds, vegetative matter, and other debris that could contain noxious weeds seeds or propagative material prior to entering the project area and before leaving infested areas. Areas appropriate for cleaning equipment will be designated as appropriate.</p>	<p><u>All Alternatives:</u> All Thinning with Removal and Mastication Units</p>	<p>Forest Plan 21-53</p>
Invasive Species-2	<p>High priority non-native invasive species sites will be flagged prior to project implementation with orange/black flagging labeled with “invasive species.” Equipment, vehicles, and personnel will avoid working within these flagged high priority areas. Mastication, equipment piling, and pile burning will not occur within these high priority areas.</p>	<p><u>All Alternatives:</u> 136-145, 137-8, 138-11, 138-46, 138-56, 138-71, 138-74, 138-151, 138-155, 138-501, 544-17, 544-19, 544-20, 544-222, UB1, UB2, UB4, FBR2, FBR3, FBR4, FBS2, 138-MAST-1, 138-MAST-4</p>	<p>Forest Plan 21-53</p>

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Invasive Species-3	If potential landing sites are infested with noxious weeds, consult with the district botanist to determine appropriate methods for containing and/or managing the infestation. Methods may include blading infested soil away from activity zones and covering this soil; or adding a barrier to the landing so seed banks cannot be transported.	<u>All Alternatives:</u> All Thinning with Removal Units	Forest Plan 21-53
Invasive Species-4	Any straw or seed placed within the project area must be documented as California certified weed free. Other materials where State inspection protocol does not exist (gravel, wood chips) used as mulch in the project area should be inspected by a Forest Service representative to determine the potential for spread of noxious weeds.	<u>All Alternatives:</u> All Units	Forest Plan 21-53
Invasive Species-5	Any facility that provides material such as rock, gravel, or boulders to be used in the project area should be inspected and determined to have limited potential for the spread of noxious weeds from stored material. Material stockpiles must be noxious weed free.	<u>All Alternatives:</u> All Units	Forest Plan 21-53
Scenery-1	Where feasible, along ridgetops that are visible from the Yreka community, minimize landing size, number and width of cable corridors, and use parallel cable sets for skyline and endline units.	<u>All Alternatives:</u> 138-102G, 135-56S, 138-155S, 544-17S, 544-19S, 544-222S, 138-46E, 544-20E	Forest Plan 11-1, 11-3, 11-4, 11-6.
Scenery-2	For all treatments that are visible from the Yreka community, avoid straight line appearances in the landscape along treatment edges. Vary the width of all ridgeline and roadside fuels treatments, or respond to existing vegetation density outside of all treatments to minimize line contrasts.	<u>All Alternatives:</u> Units 138-11G, 138-11S, 138-102G, 135-56S, 138-155S, 544-17S, 544-19S, 544-222S, 138-46E, 544-20E, 137-MAST, 138-MAST, 544-MAST, FBP-1, FBP-4, FBR-1, FBR-2, FBR-4, FBS-1, FBS-4	Forest Plan 11-1, 11-3, 11-4, 11-6.

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Scenery-3	<p>Treat slash within 100 feet of dispersed recreation sites identified by Motor Vehicle Use Map access roads and designated recreational trails, and along Forest Plan identified moderately sensitive (visually) road segments. Additionally, treat slash within all landings along Forest Plan identified moderate sensitive Forest Routes (roads and trails). Treatment methods may vary as practical, with the desired future condition perpetuating a natural appearance. Ensure slash is abated as soon as practical, but no later than three years' time post-project completion in order to meet Retention, Partial Retention, and Modification Visual Quality Objectives.</p>	<p>All Alternatives: Forest Routes (Moderate Sensitivity): 45N28, Siskiyou County 7G-01 (Greenhorn Road).</p> <p>Access Roads to Dispersed Sites: 51D027, 51D025, 51D02</p> <p>Trails: 5594, 5596, 55109</p> <p>Treatment Units: 133-89G, 134-55G, 134-58G, 134-242G, 134-240G, 138-11G, 138-11S, 138-46S, 38-56S, 138-102P, 138-155S, 138-70P, 544-17S, 544-19S, 544-20E, 544-222S, UB1, UB5, FBP1, FBR1, FBR2, FBR3, FBS1, FBS3</p>	<p>Forest Plan 11-1, 11-3, 11-4.</p>
Scenery-4	<p>For all treatment units along moderate sensitive Forest Routes (roads and trails), and adjacent to dispersed recreation sites identified by Motor Vehicle Use Map access roads in the project area, low-stump (6-8" or less) all higher concentrations of cut trees that are visible on uphill and downhill slopes from the roadside viewing area.</p>	<p>All Alternatives: Forest Routes (Moderate Sensitivity): 45N28, Siskiyou County 7G-01 (Greenhorn Road).</p> <p>Access Roads to Dispersed Sites: 51D027, 51D025, 51D02</p> <p>Trails: 5594, 5596, 55109</p> <p>Treatment Units: 133-89G, 134-33S, 134-34G, 134-55G, 134-58G, 134-107S, 134-242G, 134-240G, 138-11G, 138-11S, 138-46E, 138-102P, 138-155S, 138-70P, 544-17S, 544-19S, 544-20E, 544-222S FBP1, FBR1, FBR2, FBR3, FBS1, FBS3, FBS-4</p>	<p>Forest Plan 11-1, 11-3, 11-4.</p>

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Scenery-5	Minimize visible paint in those treatment units along all moderate sensitive Forest Routes (roads and trails) in the project area, and in or near any dispersed recreation sites identified by Motor Vehicle Use Map access roads.	<p>All Alternatives: Forest Routes (Moderate Sensitivity): 45N28, Siskiyou County 7G-01 (Greenhorn Road).</p> <p>Access Roads to Dispersed Sites: 51D027, 51D025, 51D02</p> <p>Trails: 5594, 5596, 55109 Treatment Units: 133-89G, 134-33S, 134-34G, 134-55G, 134-58G, 134-107S, 134-242G, 134-240G, 138-11G, 138-11S, 138-46E, 138-102P, 138-155S, 138-70P, 544-17S, 544-19S, 544-20E, 544-222S FBP1, FBR1, FBR2, FBR3, FBS1, FBS3, FBS-4</p>	Forest Plan 11-1, 11-3, 11-4.
Recreation-1	<p>For all dispersed recreation sites (designated by Motor Vehicle Use Map access roads) that are used as landings or for other purposes during harvest operations:</p> <ul style="list-style-type: none"> • Maintain the existing area footprint wherever practical (avoid enlarging the area). • Clear slash, logs, or other activity-generated debris as soon as practical at the close of operations for that area. 	All Alternatives: Access Roads to Dispersed Sites: 51D027, 51D025, 51D02	Forest Plan 12-9
Recreation-2	Repair or replace recreational signing or other facilities and trail settings if damaged during project implementation.	<u>All Alternatives:</u> All Units Where Applicable	Forest Plan 12-3
Recreation-3	Provide safety signing along trails, roads, or for temporary road or trail closures in active project areas for public safety.	<u>All Alternatives:</u> All Units Where Applicable	Forest Plan 12-3
Recreation-4	Provide visitor information about area/road/trail closures, or other recreation setting changes, in news releases, on-site, and on the Forest website.	<u>All Alternatives:</u> All Units Where Applicable	Forest Plan 12-3
Recreation-5	No ground-based logging equipment shall cross any designated trail in the project area unless the Landscape Architect and/or District Recreation Officer is consulted for mitigation measures.	<p><u>All Alternatives:</u> Trails: 5594, 5596, 55109 Units 134-240G, 134-55G, 134-245G, 134-58G, 133-89G</p>	Forest Plan 12-14

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Recreation-6	No hauling on Forest Service roads shall occur on the following holiday weekends during the recreation season: Memorial Day weekend, July 4 th weekend, and Labor Day weekend.	<u>All Alternatives:</u> All thinning with forest product removal units.	Forest Plan 12-8
Recreation-7	When possible, schedule burning to minimize impacts to those recreating. This may involve burning on low visitor use days in the spring and avoiding burning on high use weekends.	<u>All Alternatives:</u> All Pile Burning and Underburn Units	Forest Plan 12-9
Watershed-1	Ground-disturbing activities are proposed to take place during the normal operating season (NOS) that is defined as May 1 to October 31 and in dry periods outside the NOS, adhering to the Forest's wet weather operation standards (USDA 2002), as approved by the Forest Service representative. * When working in hydrologic riparian reserves: When there is a 30 percent chance of rain in the next 24 hours, a Forest Service representative will be on site to insure that winterization or erosion control procedures are implemented in a timely fashion and to initiate shutdown or resume operations. *Operations will not resume until suitable weather, soil, and forecast conditions exist.	<u>All Alternatives:</u> All Thinning with Removal and Mastication Units	(R5 BMP 1.5, 5.6)
Watershed-2	Post-treatment soil cover will range from 50 to 80 percent depending on slope steepness, soil texture, and fuel reduction treatments.	<u>All Alternatives:</u> All Thinning and Mastication Units	(R5 BMP 5.5), Forest-wide S&G 3-2
Watershed-3	Maintain existing coarse woody debris by having ground-based equipment avoid the larger diameter woody debris as much as practical.	<u>All Alternatives:</u> All Thinning with Removal and Mastication Units	(R5 BMP 5.5), Forest-wide S&G 6-16

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Watershed-4	<p>Mechanized equipment will be restricted to:</p> <ol style="list-style-type: none"> 1. If soil texture is Loam or finer: Slopes less than 45 percent 2. If soil texture is Sandy Loam or coarser: Slopes less than 35 percent 3. Mechanized equipment will be restricted to travelling generally in straight up and down patterns on slopes 35 to 45 percent and on steeper slopes for short portions (100 feet or less) regardless of texture when necessary 4. Where equipment will be operating on >45% slopes for more than just short stretches a cable-assist tether will be required. 5. In stands where tractor skidding is used and, where practical, logs should be placed in bundles on slopes less than 35 percent. 6. Skid trails that connect benches separated by short steep slopes (broken ground) can have minor portions (100 feet or less) of the skid trail on slopes greater than 35 percent. <p>Soil texture will be determined by the project soil scientist.</p>	<p><u>All Alternatives:</u> All Thinning with Removal and Mastication Units</p>	<p>National Core BMP Veg-4 (R5 BMP 1.9)</p>
Watershed-5	<p>Skidding equipment can operate in terraced plantations with slopes greater than 35 percent with the following restrictions: terraces will be used that are generally wide enough to accommodate harvesting and skidding equipment to limit increasing the cut and fill slopes on terraces. Skidding between terraces will be limited and locations of these skid trails will be flagged by the timber sale administrator with input from the project soil scientist.</p>	<p><u>All Alternatives:</u> All Thinning with Removal Units</p>	<p>(R5 BMP 1.10)</p>
Watershed-6	<p>No full bench skid trails will be constructed except in terraced plantations and then only on existing terraces. (Full bench skid trails have the entire skid trail cut into the hill slope).</p>	<p><u>All Alternatives:</u> All Thinning with Removal Units</p>	<p>(R5 BMP 1.10)</p>

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Watershed-7	Existing skyline corridors and ground-based skid trails will be reused whenever possible. Designation of new skid trails will be approved by Timber Sale Administrator. Use existing skid and swing trails instead of building new skid trails unless using existing skid trails will have greater negative effects than building new. Use no skid trails in areas (1) in which ground-based mechanical equipment is excluded; and (2) on highly erosive soils, unstable areas, wetlands, or wet meadows (excluding small springs and seeps).	<u>All Alternatives:</u> All Thinning with Removal Units	(R5 BMP 1.10)
Watershed-8	Ground-based skidding and skyline cable yarding will require front-end suspension of logs on skid trails and corridors.	<u>All Alternatives:</u> All Thinning with Removal Units	(R5 BMP 1.10)
Watershed-9	Tractors and mechanical harvesters will be excluded from active landslides, toe zones of dormant landslides and inner gorges unless reviewed and recommended by a geologist.	<u>All Alternatives:</u> All Thinning with Removal Units	(R5 BMP 1.6)
Watershed-10	Limit equipment disturbance within 20 feet on either side of swales by minimizing equipment crossings and avoiding running trails up the axis of swales. Swales are shallow ephemeral channels that do not meet the definition of a riparian reserve because they lack annual channel scour.	<u>All Alternatives:</u> All Thinning and Mastication Units	National Core BMP AqEco-1, AqEco-2 and Veg-3 (R5 BMP 1.19)
Watershed-11	Place corridors for skyline-yarding outside hydrologic riparian reserves parallel to the stream channel unless field assessment by soil scientist and sale administrator determines that placing them within the riparian reserve will not substantially damage residual trees, soil, or fish. Full suspension will be required for any yarding across or over perennial and intermittent streams to avoid damage to stream banks.	<u>All Alternatives:</u> All Thinning with Removal Units	National Core BMP Veg-5 (R5 BMP 1.8, 1.11)
Watershed-12	Cable corridors will be placed on the landscape as to minimize disturbance to unstable lands (such as inner gorges, active landslides and toe zones). The layout will avoid yarding logs up the axis of the features.	<u>All Alternatives:</u> All Thinning with Removal Units	(R5 BMP 1.6)

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Watershed-13	Trees may be removed from riparian reserves if i. Trees must be removed to provide safe road passage or campground access and function; OR ii. Those trees would pose a substantial risk to the forest road drainage system integrity; OR iii. A fish biologist ensures that removal of these trees within riparian reserves is consistent with the Aquatic Conservation Strategy objectives.	<u>All Alternatives:</u> All Thinning with Removal Units	National Core BMP Plan-3 (R5 BMP 1.8)
Watershed-14	Trees directly rooted into the banks or otherwise and obviously integral to the stability of the channel bank will not be removed. Trees in the uplands will be directionally felled to protect stream banks.	<u>All Alternatives:</u> All Thinning Units	National Core BMP AqEco-1, AqEco-2 and Veg-3 (R5 BMP 1.19)
Watershed-15	To minimize the concentration of surface runoff, slash or water bars will be applied to corridors, skid and swing trails where the ground cover is below 50 percent and where necessary to prevent runoff from entering the swing trails and stream channels. At project completion, permanent operating waterbars will be installed and/or repaired as necessary.	<u>All Alternatives:</u> All Thinning with Removal Units	(R5 BMP 1.10, 1.17)
Watershed-16	Perennial streams, even if dry, will not be crossed by skid trails. Intermittent channels may be crossed when dry and at locations designated by the Forest Service.	<u>All Alternatives:</u> All Thinning with Removal Units	National Core BMP AqEco-1, AqEco-2 and Veg-3 (R5 BMP 1.19)
Watershed-17	Skid trails that cross intermittent streams or dry swales (i.e. depressions in the landscape that do not meet the definition for a designation as riparian reserve) will be restored before any storm (with reasonable chance of causing offsite sediment movement), or after use is complete. This generally consists of removing excess soil, reshaping and waterbarring former approaches, and spreading slash on the former crossing.	<u>All Alternatives:</u> All Thinning with Removal Units	National Core BMP AqEco-1, AqEco-2 and Veg-3 (R5 BMP 1.19)
Watershed-18	Dry intermittent streams may be crossed by a masticator at designated sites only after field review and approval by a Forest Service hydrologist. No perennial streams, even when dry, will be crossed.	<u>All Alternatives:</u> All Mastication Units	National Core BMP AqEco-1, AqEco-2 and Veg-3 (R5 BMP 1.19)

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Watershed-19	<p>Masticators will not operate within 150 feet of slope distance on perennial streams and 100 feet of slope distance on each side of intermittent streams, or the site potential tree height distance on each side of the stream, whichever is greatest (per Aquatic Conservation Strategy Objective 8). A masticator will not operate beyond the break in slope of any inner gorge. Consultation with the project fish biologist or hydrologist will occur to determine if any additional buffer width for masticator equipment is needed for a particular riparian reserve.</p>	<p><u>All Alternatives:</u> All Mastication Units</p>	<p>National Core BMP AqEco-1, AqEco-2 and Veg-3 (R5 BMP 1.19)</p>
Watershed-20	<p>Existing landings will be used to the extent possible. Construct new landings outside both hydrologic and unstable-land riparian reserves and away from locations where sediment is likely to enter streams (areas that have a hydrologic connection to streams). If the existing landings are within 50 feet of slope distance to a stream channel or inner gorge they will not be used without consultation with the project hydrologist.</p>	<p><u>All Alternatives:</u> All Thinning with Removal Units</p>	<p>National Core BMP Veg-6 (R5 BMP 1.12)</p>
Watershed-21	<p>Once project activities are completed, re-establish natural runoff patterns on those landings used for the project (hydrologic stabilization) to protect water quality. Minimize sidecasting of material during maintenance, construction or reconstruction of landings. Use slash or straw to stabilize disturbed soil on fill slopes.</p>	<p><u>All Alternatives:</u> All Thinning with Removal Units</p>	<p>National Core BMP Veg-6 (R5 BMP 1.16)</p>
Watershed-22	<p>Fueling and servicing of vehicles used for proposed activities will be done outside of hydrologic riparian reserve except at designated landings in locations where most disconnected from water resources</p> <p>A spill containment kit will be in place where refueling and servicing take place. Report spills and initiate appropriate clean-up action in accordance with applicable state and federal laws, rules and regulations. The forest hazardous materials coordinator's name and phone number shall be available to Forest Service personnel who administer or manage activities utilizing petroleum-powered equipment.</p> <p>In the occurrence of a spill which may affect listed aquatic species, NOAA Fisheries will be notified for emergency consultation.</p>	<p><u>All Alternatives:</u> All Units</p>	<p>National Core BMP Road-10 (R5 BMP 2.11)</p>

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Watershed-23	Use temporary roads on existing roadbeds instead of constructing new temporary roads except: (1) when temporary roads on existing roadbeds are located within stream-course riparian reserves (unless the only way to access the unit will be to use a stream crossing on an existing roadbed); or (2) when temporary roads on existing roadbeds are located on highly erosive soils, active landslides, wetlands or meadows (excluding small springs and seeps).	<u>All Alternatives:</u> All Temporary Roads	National Core BMP Road-3 (R5 BMP 2.3)
Watershed-24	Improvements to existing roads in the project area will not over-steepen road cuts, will minimize sidecasting, and maintain the ditches and cross drains or any outslope of the roadway.	<u>All Alternatives:</u> All Applicable Roads	National Core BMP Road-3 (R5 BMP 2.3)
Watershed-25	Spot rocking will be used as necessary if small and isolated portions of the road system do not adequately dry to allow haul when most of the road is capable of haul. Ensure haul over the newly rocked areas will not create adverse impacts, such as sediment moving offsite towards channels.	<u>All Alternatives:</u> All Applicable Roads	National Core BMP Road-4 (R5 BMP 2.4)
Watershed-26	Existing low water crossings where forest transportation system roads cross perennial or intermittent streams will have temporary stream crossings installed for forest product removal, as approved by the project fisheries biologist. Installation and removal will be seasonally restricted as crossing will be installed during the operating season only and removed prior to end of the operating season of use. No project related non-passenger vehicles will cross the stream at these locations when/if the temporary stream crossing is not in place. Project-related passenger vehicle use will be monitored and suspended if resource damage is likely to occur from continued use.	<u>Alternative 2:</u> Forest Road 45N53 and 45N88 <u>Alternative 3:</u> Forest Road 45N53	National Core BMP Road-7 (R5 BMP 2.8)
Watershed-27	Take-offs of temporary roads, skid and swing trails that intersect roads will be obliterated or effectively blocked to vehicle access following unit treatment.	<u>All Alternatives:</u> All Thinning with Removal Units	(R5 BMP 1.10)

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Watershed-28	Temporary roads on existing road beds and new temporary roads will be blocked at the end of the normal or extended operating season when project activities cease due to wet weather conditions. All temporary roads will be hydrologically restored at project completion, which may include removal of culverts and fills at stream crossings, out-sloping of road surfaces, obliteration of road segments, and water barring or covering with slash.	<u>All Alternatives:</u> All Temporary Roads	National Core BMP Road-3 (R5 BMP 2.3)
Watershed-29	On roads treated for dust abatement, use erosion control methods such as watering only when necessary and applying non-excessive volumes to prevent any sedimentation of streams.	<u>All Alternatives:</u> All Applicable Roads	National Core BMP AqEco-1, AqEco-2 and Veg-3 (R5 BMP 1.19)
Watershed-30	<ul style="list-style-type: none"> • Water drafting by more than one truck shall not occur simultaneously. • Pumping will be terminated before tank overflows occur. • Intakes, for trucks and tanks, shall be placed parallel to the flow of water and screened, with opening size consistent with the protection of aquatic species of interest. 	<u>All Alternatives:</u> All Water Drafting Sites	National Core BMP WatUses-3 (R5 BMP 2.5)
Watershed-31	<p>Drafting from fish-bearing (anadromous) waters Use NOAA Fisheries Water Drafting Specifications:</p> <ul style="list-style-type: none"> • When in habitat potentially occupied by Coho Salmon, intakes will be screened with 3/32" mesh for rounded or square openings, or 1/16 inch mesh for slotted openings. When in habitat potentially occupied by steelhead trout, intakes will be screened with 1/8" mesh size. Wetted surface area of the screen or fish-exclusion device shall be proportional to the pump rate to ensure that water velocity at the screen surface does not exceed 0.33 feet per second. Use of a NOAA approved fish screen will ensure the above specifications are met. • Pumping rate will not exceed 350 gallons-per-minute (gpm) or 10 percent of the flow of the anadromous stream drafted from. 	<u>All Alternatives:</u> All Water Drafting Sites	National Core BMP WatUses-3 (R5 BMP 2.5)

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Watershed-32	<p>Drafting from fish-bearing (non-anadromous) waters</p> <ul style="list-style-type: none"> • Drafting rate should not exceed 350 gpm for streamflow greater than or equal to 4.0 cubic-feet-per-second (cfs). • Below 4.0 cfs, drafting rates should not exceed 20 percent of surface flows. • Drafting should cease when bypass surface flows drop below 1.5 cfs. • Use screen sizes described by NOAA specifications for steelhead (1/8 inch mesh size) for rainbow trout. 	<p><u>All Alternatives:</u> All Water Drafting Sites</p>	<p>National Core BMP WatUses-3 (R5 BMP 2.5)</p>
Watershed-33	<p>Drafting from non-fish-bearing waters</p> <ul style="list-style-type: none"> • Drafting rate should not exceed 350 gallons per minute for stream flow greater than or equal to 2.0 cfs. • Drafting rate should not exceed 50 percent of surface flow. • Drafting should cease from when bypass surface flow drops below 10 gallons per minute. 	<p><u>All Alternatives:</u> All Water Drafting Sites</p>	<p>National Core BMP WatUses-3 (R5 BMP 2.5)</p>
Watershed-34	<p>Water drafting sites located in non-fish-bearing waters only may include minor instream modification, such as fine sediment removal and building of board/plastic dams, at the discretion of the project fish biologist or hydrologist. All boards and plastic will be removed after use. Approaches may be rocked.</p> <p>Water drafting sites located within fish-bearing stream segments may not be modified, except rocking the approach to prevent sedimentation.</p>	<p><u>All Alternatives:</u> All Water Drafting Sites</p>	<p>National Core BMP WatUses-3 (R5 BMP 2.5)</p>
Watershed-35	<p>Ignition of underburns will generally not occur in riparian reserves, except to minimize the potential for burning material to roll down into a riparian reserve that would increase the potential for moderate or high intensity burns. Ignition will generally occur outside of riparian reserves (in upland areas) to avoid possibility of drip torch fuel entering stream courses. Fire will be allowed to back into riparian reserves to allow for a low intensity fire.</p>	<p><u>All Alternatives:</u> All Underburn Units</p>	<p>6.3</p>

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Watershed-36	<p>Restrictions for hand pile construction</p> <ul style="list-style-type: none"> Place in a checkerboard pattern whenever possible (not one pile directly above another). Hand piles must be small in size, 6 feet or less in diameter. <ul style="list-style-type: none"> No hand piles within 15 feet of any perennial or intermittent stream channel. Between 15 and 30 feet, hand piles may be constructed if the following conditions exist: (1) not granitic soils, (2) slope is less than 35 percent, or (3) ground cover is greater than 50 percent. If the condition cannot be met, then slash should be lopped and scattered. 	<u>All Alternatives:</u> All Fuel Break and Thinning Units	National Core BMP Fire-2 (R5 BMP 6.3)
Watershed-37	<p>Burning hand piles within riparian reserves</p> <ul style="list-style-type: none"> See Watershed-36 for hand pile construction description. <p>If perennial streams are greater than 1 foot in width</p> <ul style="list-style-type: none"> Only hand piles greater than 30 feet from the channel may be burned. <p>If intermittent and small (less than 1 foot in width) perennial streams</p> <ul style="list-style-type: none"> Hand piles greater than 15 feet from the channel may be burned. 	<u>All Alternatives:</u> All Fuel Break and Thinning Units	National Core BMP Fire-2 (R5 BMP 6.3)
Watershed-38	<p>For underburning, construction of handlines in riparian reserves closer than 25 feet to a watercourse shall be avoided where practical. Handline construction in riparian vegetation shall be avoided where practical. Handlines will be mitigated (waterbarred and covered with organic material) immediately following prescribed burning, when safe to do so.</p>	<u>All Alternatives:</u> All Underburn Units	National Core BMP Fire-2 (R5 BMP 6.3)
Watershed-39	<p>When underburning in riparian reserves, at least 90 percent of the large woody debris will not be consumed, both standing and on the ground.</p>	<u>All Alternatives:</u> All Underburn Units	National Core BMP Fire-2 (R5 BMP 6.3)
Wildlife-1	<p>Retain at a minimum two to five snags on an average per acre where available. This is to be assessed on a landscape level. Snag retention may not be met equally on every acre but will be met at a landscape scale. Retain snags in clumps or groups, situated around the largest and live trees where possible. Select snags with broken tops as first priority.</p>	<u>All Alternatives:</u> All Units	Forest Plan S&G 8-22
Wildlife-2	<p>Maintain existing snag and coarse woody debris levels across the landscape where fuel loading is not excessive; average five to 20 pieces, greater than 12 inches in diameter, per acre.</p>	<u>All Alternatives:</u> All Units	Forest-wide S&G 6-16

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Wildlife-3	A seasonal restriction (limitation of operations) of February 1st to September 15th will apply to all activities that modify habitat (including activities that degrade or are beneficial) within 0.25 miles of a NSO activity center or un-surveyed nesting/roosting/foraging habitat. The limiting operating period (LOP) may be lifted if protocol surveys determine NSOs are not nesting in the year of action.	<u>All Alternatives:</u> All Applicable Units	Forest Plan S&G 8-1, 8-2
Wildlife-4	A seasonal restriction will be applied from February 1st through July 9 th for activities that are not in suitable habitat but will potentially produce noise above ambient noise levels within 0.25 miles of an occupied NSO activity center or un-surveyed suitable nesting/roosting/foraging habitat. The LOP may be lifted if protocol surveys determine NSOs are not nesting in the year of action.	<u>All Alternatives:</u> All Applicable Units	Forest Plan S&G 8-1, 8-2
Wildlife-5	When spring burning is conducted within 0.25 miles and uphill of a known NSO activity center or within 0.25 miles of un-surveyed nesting/roosting/foraging habitat (separated by a topographic feature), smoke will be managed with the objective of light to moderate, dispersed smoke being present with a canyon or drainage but dissipating or lifting within 24 hours. Ignition will be discontinued if heavy, concentrated smoke begins to inundate suitable habitat late in the afternoon	<u>All Alternatives:</u> All Applicable Units	Forest Plan S&G 8-1, 8-2
Wildlife-6	No known bald eagle nest trees, perch trees, or roost trees within winter roost areas will be removed or destroyed as a result of project activities if discovered.	<u>All Alternatives:</u> All Applicable Units	Bald and Golden Eagle Act
Wildlife-7	To minimize effects on bald eagles, prescribed burning will not occur in or within 0.5 miles of a known or suspected nest territory from January 1st to August 31 st . Activities that create noise above ambient levels within 0.25 miles of active or suspected bald eagle nests if discovered, or occur within 0.5 miles of line-of-sight of such nests, will be seasonally restricted from January to August 31. If surveys demonstrate that nest sites are not active, no seasonal restrictions are required.	<u>All Alternatives:</u> All Applicable Units	Bald and Golden Eagle Act
Wildlife-9	In known occupied northern goshawk nest sites and management areas, no burning or use of heavy equipment will occur within 0.25 miles of the nest site between March 1st and August 31st. If protocol surveys are conducted and the site is found to be unoccupied, proposed actions may proceed.	<u>All Alternatives:</u> All Applicable Units	Forest Plan S&G 8-20

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Wildlife-10	In order to avoid direct harm to individual Siskiyou Mountain salamanders, in occupied sites or areas modeled as having moderate or high likelihood of occupancy; implement burning when salamanders have low likelihood of being surface active (mid-summer and mid-winter months). Consult with the district wildlife biologist to determine when there is a low likelihood of surface activity.	<u>All Alternatives:</u> All Applicable Units	Forest Plan S&G 8-18
Wildlife-11	Avoid use of heavy equipment on known Siskiyou Mountain salamander sites, or on suitable talus that has a moderate or high likelihood of occupancy for the Siskiyou Mountain and Scott Bar salamander and for the Tehama chaparral and blue gray tail dropper.	<u>All Alternatives:</u> All Applicable Units	Forest Plan S&G 8-18, ROD for Survey and Manage species
Wildlife-12	Treatment units containing suitable Siskiyou Mountain salamander habitat or known sites will be flagged and avoided or surveyed prior to ground disturbing activities; flagged areas will be utilized as "skips" considered in variable density thinning prescriptions.	<u>All Alternatives:</u> All Applicable Units	Forest Plan S&G 8-18, ROD for Survey and Manage species
Wildlife-13	Greater than 60 percent of the existing canopy cover of the larger mature trees, large down woody debris, and sufficient forest floor litter will be retained within and adjacent to known sites of Tehama chaparral and blue gray tail dropper.	<u>All Alternatives:</u> All Applicable Units	Forest Plan S&G 8-18, ROD for Survey and Manage species
Wildlife-14	Pre-disturbance surveys for Category A survey and manage species will be completed to protocol prior to ground-disturbing activities where suitable habitat exists. Known mollusk sites will be flagged and buffered by one site tree height by the District biologist prior to implementation. No treatments will occur within this buffer; flagged areas will be used as "skips" considered in variable density thinning prescriptions.	<u>All Alternatives:</u> All Applicable Units	Forest Plan S&G 8-18, ROD for Survey and Manage species
Wildlife-15	Minimize potential logging damage and negative effects to retained hardwoods and sensitive meadow habitats by using techniques such as directional felling away from these trees and meadows, and restricting equipment use in meadows. For hardwoods in tree form, retain except where removal is required for operability or fuel break function. Include in leave tree spacing.	<u>All Alternatives:</u> All Thinning, Fuel Break and Mastication Units	Forest Plan S&G 8-31, 8-42. 8-43

Design Feature	Description	Applicable Action Alternatives/ Areas or Units	Rationale or Applicable Standard and Guideline
Wildlife-16	Retain up to 25% of area in planned fuel break and mastication treatments as untreated islands and irregular edge to retain diversity for wildlife habitat needs where fuel break effectiveness would not be compromised. Residual hardwood trees and conifers count towards untreated area.	<u>All Alternatives:</u> 137-Mast, 138-Mast-1, and 544-Mast	Forest Plan S&G 6-2
Wildlife-17	<p>If a gray wolf den site is detected in or near the project area during the project implementation timeframes, a seasonal restriction that restricts above ambient noise- and smoke- generating activities within one mile of the den will be implemented from April 1 through June 30.</p> <p>While the provision for the den site seasonal restriction is expected to provide protection from any prolonged or substantial project-related disturbance during the critical pup-rearing period at early rendezvous site(s), a similar seasonal restriction for activities within one mile of any discovered active rendezvous sites from April 1 through August 31 will be implemented. Further discussions and coordination with USFWS may result in modified distances or more flexible dates for this specific protection measure.</p> <p>These seasonal restrictions will be implemented unless there are topographic features or terrain that clearly separates the noise- or smoke- generating activity from the den or rendezvous site(s).</p> <p>While there are no known den or rendezvous site(s) associated with the Craggy Project area at this time, the seasonal restriction specific to gray wolf will be included in the timber sale contract and would be put in place if these sites are confirmed. These measures will also be included in the burn plan and any other implementation contracts or plans.</p>	<u>All Alternatives:</u> All Applicable Units	Forest Plan S&G 8-1, 8-2

2.3 Alternatives Considered But Eliminated From Detailed Study

Public comments received in response to the proposed action (as scoped) provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives may have been outside the scope of the need for the proposal, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm.

Therefore, a number of alternatives were considered, but eliminated from detailed study for reasons summarized below.

Alternative A

This is the project as initially prepared for scoping in 2014. It included fewer acres of hazardous fuels reduction activities than what is now proposed in Alternative 2. Legacy road sediment site treatment was not included in the initial proposal. The level of proposed treatments are listed below:

- Fuel break - 404 acres
- Prescribed underburning - 3,466 acres
- Mastication - 271 acres
- Thinning without forest product removal - 431 acres
- Thinning with forest product removal - 2,402 acres
- Roads likely to be used for forest product removal - 85 miles
- Temporary road on existing roadbed - 12.7 miles
- New temporary road - 0.5 miles

Ongoing consultation with U.S. Fish and Wildlife Service and CALFIRE, in addition to an internal reassessment of the project, determined that the lower level of treatments in the wildland urban interface proposed in this alternative would not have been sufficient to meet the desired condition for hazardous fuel reduction and forest health. Because it does not meet the purpose and need of the project, it has therefore been excluded from more detailed study (see a map of this alternative in the Scoping Outcome Summary, available on the project website).

Alternative B

This alternative was developed in response to Relevant Issue 1 to address the point of discussion about effectiveness of the project for protecting private landowners and private property. Treatments proposed in Alternative B are identical to Alternative 2 except fuel break treatments are increased to 3,220 acres. This change resulted from interaction with CALFIRE representatives at the scoping period open house and a follow-up meeting which recommended additional treatment of a 300-foot buffer adjacent to all private land in the project area. This area would be treated as a fuel break to reduce hazardous fuels. Including treatment on all lands adjacent to private land was determined to be unfeasible because doing so is not consistent with standards in the Forest Plan due to one of the following reasons: the location of proposed fuel breaks is within riparian reserves or; the location of treatments on mid-slope positions is not conducive to wildfire suppression. Additionally, many private parcels of land within the project area do not have occupied structures or residences. Fuel break treatments adjacent to these non-occupied parcels would not contribute to the safety of private landowners who do not reside on their property. For these reasons, this alternative has been eliminated from more detailed study and additional fuels treatment adjacent to private property in strategic areas has been added to Alternative 3 (see map for Alternative B in

Appendix A of the Scoping Outcome Summary on the project website, entitled, “Craggy Project Alternative B,” page 11).

Alternative C

A commenter stated that the project should treat all ponderosa pine plantations because they are “at risk to bark beetle caused mortality which will add to fuel loading over time” (Comment 11-5, Scoping Outcome Summary). In response to the comment, we developed an alternative consisting of treatment of all planted areas within the project boundary (because spatial records are incomplete as to the original species or range of species planted and field survey has determined that most planted areas are stocked with ponderosa pine, all areas recorded as planted were included in this alternative). This would total about 6,310 acres of treatments (see map in the Scoping Outcome Summary).

Records indicate some of these planted areas have been treated within the past 15 years and are not likely susceptible to insect-caused mortality. Other planted areas have been determined to be unfeasible for treatment because of the economic and environmental cost of opening closed roads formerly used to access these plantations. Finally, some planted areas are located on lower slope positions on the landscape and hazardous fuel reduction treatments in lower slope positions would not significantly contribute to improving fire resiliency since they are not expected to burn at high severity nor contribute to firefighter safety.

Alternative C is also redundant because Alternatives 2 and 3 include plantations in need of silvicultural treatment that are strategically located on ridgelines, upper slope positions, and near ingress and egress routes where treatment would contribute to landscape resilience to fire. In total, Alternative 2 would treat 4,170 acres, or 66 percent of the planted area within the project boundary; Alternative 3 would treat 5,030 acres or 80 percent of the planted area. For these reasons, Alternative C will not be analyzed further.

2.4 Monitoring

As project actions are implemented, they are monitored by Forest Service personnel as part of normal operating procedures.

As thinning of larger trees (thinning with forest product removal, generally commercially marketable trees greater than 10 inches in diameter at breast height) and thinning of smaller trees (known as non-commercial or thinning without forest product removal) is implemented, projects are monitored by Forest Service personnel as part of normal operating procedures. Forest Service employees monitor timber marking of harvest units to ensure that prescriptions and marking guides are being followed. Forest Service sale administrators monitor the harvest to assure that Forest Plan standards and guidelines, best management practices, and project design features are being implemented. Forest Service personnel monitor thinning without forest product removal as it is being accomplished to determine if objectives are being achieved and to make sure thinning specifications are being followed.

As fuels treatments are implemented, projects are monitored as part of normal operating procedures. Prior to prescribed burning, burn plans are developed. Burn plans for prescribed fire require monitoring of the burning to ensure that project objectives are being achieved.

The application of project design features that are identified for wildlife species are monitored in implementation and effectiveness monitoring. Assumptions made pertaining to effects to species are validated.

Post-project monitoring for the spread of non-native invasive species (noxious weeds) will occur as part of Forest Plan monitoring. Results will be documented in the Forest annual monitoring reports.

The Best Management Practices Evaluation Program monitoring will occur on a sample of the best management practices appropriate for this project which are listed in Appendix D. Since many project activities do not occur within the same year, they will be included in Best Management Practices Evaluation Program monitoring pool of random sampling for up to a decade as needed. The Forest sediment and temperature monitoring plan and quality assurance project plan (USDA 2010) will be implemented for Total Maximum Daily Load compliance as displayed in the North Coast Region Basin Plan (North Coast Water Board 2011).

Monitoring to assess the implementation and effectiveness of project design features to meet soil standards and guidelines in the Forest Plan may occur in the Craggy Project. Field investigations of soil cover, soil compaction, and impacts to soil organic matter will occur on a minimum of five percent of activity areas forest wide, as described in Chapter 5 of the Forest Plan. Units will be selected randomly from all activity areas across the Forest where soil disturbing activities take place; the Craggy Project will be included in the sampling pool for soil monitoring. Results will be documented in the Forest annual monitoring reports.

2.5 Comparison of Alternatives

This section provides a summary of the treatments in each alternative and a comparison of the effects of implementing each alternative. Information in the tables are focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 2-2: Quantitative Comparison of Treatments, Roads, and Access by Alternative Considered in Detail

Treatments/Roads/Access	Alternative 1	Alternative 2	Alternative 3
Total Area Proposed for Treatment (acres)	0	10,600	11,310
Fuel Breaks (acres)	0	1,400	2,190
Adjacent to private property	0	60	650
Roadside	0	780	810
Ridgetop	0	560	730
Prescribed Underburning (acres)	0	4,160	4,430
Mastication (acres)	0	900	760
Thinning Without Forest Product Removal (acres)	0	1,270	1,690

Treatments/Roads/Access	Alternative 1	Alternative 2	Alternative 3
Thinning With Forest Product Removal (acres)	0	2,870	2,230
Legacy Sediment Site Treatment	0	78 sites as agreed upon with the Water Board	78 sites as agreed upon with the Water Board
Roads Potentially Used for Forest Product Removal (miles)	0	90	80
Low-water Crossings on System Roads Potentially Used for Hauling	0	2	1
Temporary Roads on Existing Roadbed (miles)	0	12	11
New Temporary Roads (miles)	0	2	1

Table 2-3 displays a comparison of how each alternative meets the purpose and need components for the project.

Table 2-3: Comparison of Effects of Alternatives Related to Addressing Purpose and Need

Meeting Purpose and Need	Measurement Indicator	Alternative 1	Alternative 2	Alternative 3
Defensibility and Resiliency to Wildfires, Indicator 1	Acres allowing safe direct attack (flame lengths of 4 feet or less in height in the project area)	5,262 (18%)	16,329 (55%)	17,275 (58%)
Defensibility and Resiliency to Wildfires, Indicator 2	Acres of wildfires with flame lengths of 4 feet or less in height predicted in the defense zone around communities	207	508	770
Forest Health	Stand density index (measure of inter-tree competition, a lower value indicates increased resiliency to insects and disease, and drought.)	265	148	153
Early Seral Habitat	Acres of treatment to provide early seral habitat ⁵	0	7,728	9,075
Late-successional Habitat	Acres of late-successional habitat improved in the long term	0	347	426
Sensitive Plant Species Habitat	Acres with flame lengths less than four feet predicted within the management area for <i>Calochortus persistens</i> .	376	757	757

⁵ This is a total of all acres of treatment that provide early seral habitat; there are a number of acres of overlapping treatments so this number overestimates the footprint of resulting early seral habitat.

Meeting Purpose and Need	Measurement Indicator	Alternative 1	Alternative 2	Alternative 3
Reduce Sediment Potential from Legacy Sediment Sites, Indicator 1	Sites Treated	0 sites	78 sites as agreed upon with the Water Board	78 sites as agreed upon with the Water Board
Reduce Sediment Potential from Legacy Sediment Sites, Indicator 2	Cubic Yards of Potential Sediment Removed (cubic yards of potential sediment remaining)	0 (49,290)	29,200 (20,090)	29,200 (20,090)

Table 2-4 and Table 2-5 compare how each alternative addresses the relevant issues identified during public scoping.

Table 2-4: Comparison of Measurement Indicators for Relevant Issue #1:

There is a point of discussion about the effectiveness of the project for adequately protecting private landowners and private property.

Measurement Indicator	Alternative 1	Alternative 2	Alternative 3
Potential flame length in the wildland urban interface defense zone	0-4 feet = 207 acres 4-8 feet = 126 acres 8-11 feet = 297 acres >11 feet = 405 acres	0-4 feet = 508 acres 4-8 feet = 154 acres 8-11 feet = 12 acres >11 feet = 361 acres	0-4 feet = 770 acres 4-8 feet = 95 acres 8-11 feet = 28 acres >11 feet = 142 acres
Acres treated adjacent to (within 300 feet of) private land	0	Fuelbreaks = 141 acres Thinning = 120 acres Underburn = 142 acres Mastication = 175 acres	Fuelbreaks = 766 acres Thinning = 121 acres Underburn = 197 acres Mastication = 150 acres

Table 2-5: Comparison of Measurement Indicators for Relevant Issue #2:

There is a point of discussion about the environmental effects of project activities such as temporary road construction, timber haul, landing establishment, and yarding activities on soils and aquatic resources.

Response Considerations	Measurement Indicator	Alternative 1	Alternative 2	Alternative 3
Number of new landings	Number	0	16	15
Miles of new temporary roads	Miles	0	2	1
Miles temporary roads on existing roadbed	Miles	0	12	11
Miles of road (all types) used for forest product removal	Miles	0	90	80
Number of low-water stream crossings	Number of crossings	0	2	1
Modeled environmental effects based on the Equivalent Roaded Area (ERA) model	Range of ERA risk ratios	0.15 – 0.68	0.24 – 0.73	0.22 – 0.73
Modeled environmental effects based on the landslide (GEO) model	Range of GEO risk ratios	0.29 – 1.37	0.29 – 1.29	0.29 – 1.28
Modeled environmental effects based on the soil erosion (USLE) model	Range of USLE risk ratios	0.24 – 0.66	0.30 – 0.66	0.29 – 0.66

Response Considerations	Measurement Indicator	Alternative 1	Alternative 2	Alternative 3
Treatment of legacy sediment sites	Cubic Yards of Potential Sediment Removed (cubic yards of potential sediment remaining)	0 (49,290)	29,200 (20,090)	29,200 (20,090)

Information in Table 2-6 is focused on environmental effects on resources where different levels of effects of outputs can be distinguished qualitatively or quantitatively among alternatives. For all resources in all action alternatives, negative effects are minimized or eliminated by application of project design features. This table displays the potential environmental effects of alternatives themselves, not the cumulative effects of the alternatives plus current and reasonably foreseeable actions. Cumulative effects are disclosed in chapter 3 in the environmental effects on each resource.

Table 2-6: Comparison of Effects of Alternative by Resource

Resource	Measure	Alternative 1	Alternative 2	Alternative 3
Fire and Fuels	0-4 feet flame lengths in project area (short term)	5,262 acres (18%)	16,329 acres (55%)	17,275 acres (58%)
Fire and Fuels	Surface fire type in project area (short term)	18,987 acres (64%)	22,437 acres (79%)	23,605 acres (80%)
Fire and Fuels	Fire behavior potential (0-4 foot flame lengths on dominant vegetation types (short term))	5,386 acres	15,008 acres	17,237 acres
Fire and Fuels	Fire behavior potential on vegetation size class (0-4 foot flame lengths on current vegetation size class)	3,373 acres	9,123 acres	10,626 acres
Fire and Fuels	0-4 foot flame length in WUI (short term) in the defense zone: 207 acres; threat zone: (short term))	2,874 acres	8,579 acres	10,540 acres

Resource	Measure	Alternative 1	Alternative 2	Alternative 3
Silviculture (Vegetation)	Forest health measured by Stand Density Index (SDI)	Current conditions: 265 20 years after no treatment: 301	One year after treatment: 148 20 years after no treatment: 200	One year after treatment: 153 20 years after no treatment: 299
Silviculture (Vegetation)	Forest resilience measured by heterogeneity	Resilience will stagnate and heterogeneity will be reduced over time	Resilience will be increased and heterogeneity of tree species will be maintained or enhanced Meets NFMA requirements by meeting Forest Plan standards	Resilience will be increased and heterogeneity of tree species will be maintained or enhanced where stands are treated, but to a lesser extent than Alternative 2 due to less acres treated. Meets NFMA requirements by meeting Forest Plan standards, but to a lesser extent than Alternative 2
Botany	Threatened and endangered species	No effect.	No effect.	No effect.
Botany	Forest Service Sensitive	<i>Calochortus persistens</i> : No direct effects, indirect effects from conifer encroachment. Potential indirect effects in the event of a stand replacing wildfire. <i>Calochortus persistens</i> Management Area (MA): At least 60% of the area would require more than hand tools to suppress a fire under modeled conditions. About 376 acres (40%) would be in the 0-4 foot flame length category. <i>Eriogonum ursinum var. erubescens</i> : No direct effects. Potential indirect effects in the event of a stand replacing wildfire.	<i>Calochortus persistens</i> : Meets the purpose and need of this project to address known and potential threats to this species. Maintains and improves habitat by reducing vegetation encroachment. <i>Calochortus persistens</i> MA: About 20% of the area would require more than hand tools to suppress fire. About 757 acres (80%) would be in the 0-4 foot flame length category. <i>Eriogonum ursinum var. erubescens</i> : No direct effects. Reduced indirect effects with reduction in risk of stand replacing wildfire.	Same as Alternative 2.
Botany	Survey and Manage Species	No direct or indirect effects because no survey and manage species are present within the analysis area.	Same as Alternative 1.	Same as Alternative 1.

Resource	Measure	Alternative 1	Alternative 2	Alternative 3
Weeds	Risk of spread or introduction of noxious weeds	High risk- due to non-project dependent vectors. Risk within Management Area 5 is low.	Same as Alternative 1.	Same as Alternative 1.
Wildlife	Threatened and Endangered	No effect.	<p>Northern spotted owl: May affect, not likely to adversely affect. 347 acres of foraging habitat will be degraded, none will be downgraded, and 1.5 will be removed. Critical habitat: 203 acres of foraging habitat will be degraded, none will be downgraded or removed.</p> <p>Gray wolf: No effect.</p> <p>North American wolverine (proposed for listing): May affect individuals but is not likely to lead to a trend towards Federal listing. Project activity is proposed to occur within about 347 acres (12%) of habitat; however, these habitats will continue to be viable after treatment.</p> <p>1.5 acres of habitat will be reduced to non-habitat by new landing construction.</p>	<p>Northern spotted owl: May affect, not likely to adversely affect. 426 acres of foraging habitat will be degraded, none will be downgraded, and 1.5 will be removed. Critical habitat: same as Alternative 2.</p> <p>Gray wolf: same as Alternative 2.</p> <p>North American wolverine: Same as Alternative 2, except that Project activity is proposed to occur within about 426 acres (15%) of habitat; however, these habitats will continue to be viable after treatment. Same effect from landing construction.</p>

Resource	Measure	Alternative 1	Alternative 2	Alternative 3
Wildlife	Forest Service Sensitive Species	No effect.	<p>Northern goshawk and fisher: May affect individuals but is not likely to lead to a trend towards Federal listing. Project activity is proposed to occur within about 347 acres (12%) of habitat; however, these habitats will continue to be viable after treatment. 1.5 acres of habitat will be reduced to non-habitat by new landing construction.</p> <p>Pacific marten: Degradation of about 278 acres of marten; habitat will continue to be viable after treatment.</p> <p>Bald eagle and great gray owl: No habitat affected</p> <p>Willow flycatcher, Foothill yellow-legged frog, Cascade frog: This alternative will not limit the availability of habitat for this species.</p> <p>Pallid bat, Townsend’s big-eared bat, fringed myotis bat: Will not limit the availability of large snag distribution. Forest-wide standards and guidelines for snags will be met or exceeded.</p> <p>Western bumble bee, Tehama chaparral snail (also survey and manage), Siskiyou Mountain salamander (also survey and manage): No habitat affected.</p>	<p>Northern goshawk and fisher: Same as Alternative 2, except that Project activity is proposed to occur within about 426 acres (15%) of habitat; however, these habitats will continue to be viable after treatment. Same effect from landing construction.</p> <p>Pacific marten: Degradation of about 319 acres of marten; habitat will continue to be viable after treatment.</p> <p>Bald eagle and great gray owl, Willow flycatcher, foothill yellow-legged frog, cascade frog, pallid bat, Townsend’s big-eared bat, fringed myotis bat, Western bumble bee, Tehama chaparral snail, Siskiyou Mountain salamander: Same as Alternative 2.</p>

Resource	Measure	Alternative 1	Alternative 2	Alternative 3
Wildlife	Management Indicator Species	No effect.	<p>River/stream management indicator species: Alternative 2 will not limit the availability of riparian habitat conditions.</p> <p>Snag-dependent management indicator species: Alternative 2 will not limit the availability of large snag distribution. Forest-wide standards and guidelines for snags will be met or exceeded.</p>	<p>River/stream and snag-dependent management indicator species: Same as Alternative 2.</p>
Wildlife	Survey and Manage Species	No effect.	<p>Scott Bar salamander, blue-gray tail dropper: No known sites. Surveys will be done.</p> <p>Klamath shoulderband: Known sites will be managed and surveys will be done. Tehama chaparral snail: Known site will be managed and surveys will be done.</p> <p>Siskiyou Mountain salamander: No known sites, surveys will be done.</p>	<p>Scott Bar salamander, blue-gray tail dropper, Klamath shoulderband: Same as Alternative 2.</p>
Aquatic Species	Coho Salmon (and critical habitat), Chinook Salmon, Steelhead and Rainbow Trout, Pacific and Klamath River Lamprey, and Essential Fish Habitat	Alternative 1 is not expected to have any effects on these aquatic resources.	<p>Coho Salmon: may affect, not likely to adversely affect the species or its critical habitat.</p> <p>Chinook Salmon: will not affect the species or its critical habitat.</p> <p>Steelhead and Rainbow Trout: may affect individuals, but is not likely to lead to a trend towards listing and not likely to lead to a decreasing population trend.</p> <p>Pacific and Klamath River Lamprey: may affect individuals, but is not likely to lead to a trend towards listing.</p>	Same as Alternative 2.

Resource	Measure	Alternative 1	Alternative 2	Alternative 3
Hydrology	Equivalent Roaded Area	<p>Currently under the threshold of concern- desired conditions are met. Watershed risk ratios range from 0.13-0.68. Risk ratios with the potential fire scenario range from 0.24-1.04.</p> <p>Risk ratios increased in the watersheds by an average of 73%, indicating that risk of erosion or mass wasting from the effects of wildfire is more in the event of fire without treatment than with treatment.</p>	<p>Will remain under the threshold of concern- desired conditions will be met. Risk ratios range from 0.16-0.73.</p> <p>Risk ratios with the potential fire scenario range from 0.03-0.26.</p>	<p>Will remain under the threshold of concern- desired conditions will be met. The risk ratios range is similar to Alternative 2.</p>
Hydrology	Temperature	<p>Conditions are currently met and are expected to remain the same or improve in the absence of a wildfire occurrence due to increasing streamside shade.</p>	<p>Effects will not be estimated but presumed neutral through implementation of best management practices and project design features that protect streamside canopy.</p>	<p>Same as Alternative 2.</p>
Hydrology	Peak flow	<p>Desired conditions are currently met. Expected to remain as at present in the absence of wildfire but increase substantially (negatively) with wildfire.</p>	<p>Desired conditions will be met.</p>	<p>Same as Alternative 2.</p>
Hydrology	Sediment and Legacy Sediment Sites	<p>0 sites will be treated. 49,290 cubic yards of sediment from legacy sediment sites will remain untreated.</p>	<p>Desired conditions will be met. 78 sites will be treated as agreed upon with the Water Board; 29,200 cubic yards of sediment will be stabilized.</p>	<p>Same as Alternative 2.</p>

Resource	Measure	Alternative 1	Alternative 2	Alternative 3
Soils	Soil Stability, Soil Organic Matter, and Soil Structure	Estimated acres within the project area (and percentages of treatment areas) not meeting desired conditions for all three soil indicators are as follows (soil stability, soil organic matter, soil structure): 0 acres (0%).	Estimated acres within the project area (and percentages of treatment areas) not meeting desired conditions for the three soil indicators are as follows: soil stability 157 acres (1.5%), soil organic matter 276 acres (2.6%), soil structure 105 acres (1.0%); or with the use of tethered harvesting equipment in place of skyline yarding, 179 acres (1.7%), 341 acres (3.3%), and 159 acres (1.5%) respectively.	Estimated acres within the project area (and percentages of treatment areas) not meeting desired conditions for the three soil indicators are as follows: soil stability 129 acres (1.1%), soil organic matter 228 acres (2.0%), soil structure 90 acres (0.8%); or with the use of tethered harvesting equipment in place of skyline yarding, 149 acres (1.3%), 288 acres (2.5%), 140 acres (1.2%) respectively.
Geology	Landslide Risk	Without a fire, the landslide likelihood will remain as at present and may decrease somewhat overtime. The landslide risk will remain high for some watersheds. With a wildfire event, the risk ratios will be increased to over the threshold of concern for 7 of the 8 watersheds, with the eighth watershed elevated substantially.	Without a fire, this alternative will not lead to a measureable change in the landslide risk or likelihood for any of the watersheds analyzed. With a wildfire event, the risk ratios for the 7 th field watersheds would be 30 to 68 percent less than Alternative 1. Alternative 2 is expected to overall have less effects on landslide likelihood and landslide risk than Alternative 1.	Same as Alternative 2.
Air	Compliance with the Regional Haze Rule	Alternative 1 will comply with the Regional Haze Rule, and greenhouse gas emissions will be zero.	Alternative 2 has a high likelihood of compliance with the Regional Haze Rule, and greenhouse gas emissions will be 10,670 metric tons per year.	Alternative 3 has a high likelihood of compliance with the Regional Haze Rule, and greenhouse gas emissions will be 11,605 metric tons per year.
Scenery	Scenic Integrity	Existing visual disturbances are minor and widespread. This alternative meets the Forest Plan thresholds for all sensitive views. There will be no new visual impacts; however there will be increasing future risk for ecosystem disturbances, such as high-severity wildfire and insect outbreaks.	There will be widespread new minor visual disturbances within designated viewsheds for 1-3 years. With project design features, Forest Plan VQO thresholds for all designated views and road/trail travel corridors will be met.	Same as Alternative 2.

Resource	Measure	Alternative 1	Alternative 2	Alternative 3
Recreation	Recreation Opportunity Spectrum	Overall designated Recreation Opportunity Spectrum classification thresholds would not change, as project treatments would not be implemented.	Overall designated Recreation Opportunity Spectrum classification thresholds would not change overall due to any proposed treatments, and will remain consistent with Forest plan direction.	Same as Alternative 2.
Heritage Resources	Effects to heritage resources	Alternative 1 will result in no direct or cumulative effects to archaeological sites within the Area of Potential Effect although it may increase the potential for indirect effects over the short and long term.	Alternative 2 will have no measurable negative direct effects to heritage resources are expected for these alternatives.	Same as Alternative 2.
Social and Economic Resources	Social	Use of resources: Zero acres of treatments where forest products will be made available. Fire safety: Zero acres will be treated. Zero acres of fuels will be treated adjacent to private property.	Use of resources: 2,870 acres of treatment where forest products will be made available. Fire safety: 10,600 total acres will be treated (all treatments are included). 60 acres of fuels will be treated adjacent to private property.	Use of resources: 2,230 acres of treatment where forest products will be made available. Fire safety: 11,310 total acres will be treated (all treatments are included). 650 acres of fuels will be treated adjacent to private property.
Social and Economic Resources	Economics	Revenue based on estimated timber sold (dollars): 0. Employment (number of jobs): 0. Direct labor income generated (dollars): 0.	Revenue based on estimated timber sold (dollars): 158,300. Employment (number of jobs): 45. Direct labor income generated (dollars): 1,919,300.	Revenue based on estimated timber sold (dollars): 127,000. Employment (number of jobs): 37. Direct labor income generated (dollars): 1,550,900.

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CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

This chapter summarizes the physical, biological, social, and economic environments that may be affected by the project and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in chapter 2.

Analysis methods are discussed for each resource, followed by a description of the spatial and temporal context used for analysis. The affected environment section describes the existing condition against which environmental effects are evaluated and from which progress toward the desired condition can be measured.

The environmental consequences section discusses the potential effects to the resource associated with the implementation of each alternative. This forms the scientific and analytical basis for comparison of the alternatives, including the proposed action. This section discloses direct, indirect, and cumulative effects on the resource and discusses the potential for significance of these effects. Effects are quantified where possible; qualitative discussions are included where appropriate. The proposed action and action alternatives include the project design features which were developed to minimize negative effects and are included in chapter 2.

Effects are defined as (1) direct effects caused by an action and that occur at the same place and time as the action; (2) indirect effects caused by an action but that are later in time, or removed in distance, from the action; and (3) cumulative effects resulting from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such actions. Direct and indirect effects of an action are often discussed together. Cumulative effects are discussed separately. Effects can result from individually minor, but collectively significant, actions taking place over a period of time. Past, present, and reasonably foreseeable future actions are assessed along with the effects of the proposed action and alternatives to determine whether significant cumulative effects occur.

Analysis areas for determining environmental effects vary by resource, as do the other actions included in each cumulative effects analysis. Cumulative effects in an analysis area may include estimated effects from past, present, and reasonably foreseeable future private or public vegetation treatments, road construction, grazing, and wildfire exclusion. A list of such potential actions is included in Appendix C of this document.

Resource reports provide background for the analysis, and are referenced and summarized in this chapter of the draft environmental impact statement. These reports use resource data housed in the geographic information system and other relevant sources. The reports are available on [the Project website](#).

3.2 Fire and Fuels

This section discusses the historic role of fire and how current conditions reflect a departure from historic fire return intervals in the Craggy project area and within the wildland urban interface. It also provides information on the effects of the project on fire and fuels.

3.2.1 Methodology

Methods of evaluating effects of the Craggy Project to fire and fuels are based on the Forest Plan, Forest Service Manual 5100, and Forest Service Manual 2000. The three primary variables affecting fire behavior are fuels, weather, and topography. Because fuels are the primary variable that management activity can influence, they are the main variable used in the analysis of fire hazard. Fire behavior modeling (Finney 2006) provides outputs of fire type or crown fire potential (Scott and Reinhardt 2001) and flame length potential (Finney 1998). In addition, a program which uses a vegetation layer to obtain fuel models and predicts fire behavior potential based on elevation, aspect, slope, canopy cover, stand height, canopy bulk density, and canopy base height is used (LANDFIRE). Information on historic weather conditions were obtained from remote automated weather stations at Oak Knoll and Collins Baldy. Fire behavior potential was calculated based on very dry (90th percentile) conditions. Additional information is available in the Fire and Fuels Resource Report, available on [the Project website](#).

3.2.3 Analysis Indicators and Measures

The following analysis indicators are used to compare effects of alternatives.

- **Fire hazard** measured by (1) acres of various flame length potential (representing how hot it can become and how difficult it will be to suppress the fire) and (2) fire type (acres on which a fire is likely to stay on the surface or become a passive crown fire or active crown fire). See the Fire and Fuels Resource Report for definitions of these terms and additional information.
- **Fire behavior potential** measured by flame length potential for dominant vegetation types and sizes of trees (acres of various flame lengths within vegetation types and sizes).

3.2.3 Spatial and Temporal Bounding of Analysis Area

There are two spatial bounds for this analysis. The first will be the project boundary and the second will be the area within the wildland urban interface that is associated with the Craggy Project (see Appendix D of the Fire and Fuels resource report for a map of these analysis area delineations). The effects of alternatives on all analysis indicators will be analyzed for the Craggy project area. The effects of treatments on fire hazards as measured by flame lengths (a surrogate for fire intensity) for wildland urban interface areas will be disclosed.

The wildland urban interface is divided into three concentric zones: (1) a home ignition zone of 100 feet around structures; (2) a defense zone of one-quarter mile around human developments; and (3) a threat zone of 1.5 miles. Very little federal lands occur within 100 feet of structures; therefore, the Craggy Project focuses primarily on the defense and threat zones, including areas adjacent to private land and the home ignition zone. More information on the goals of these zones is provided in the Fire and Fuels resource report.

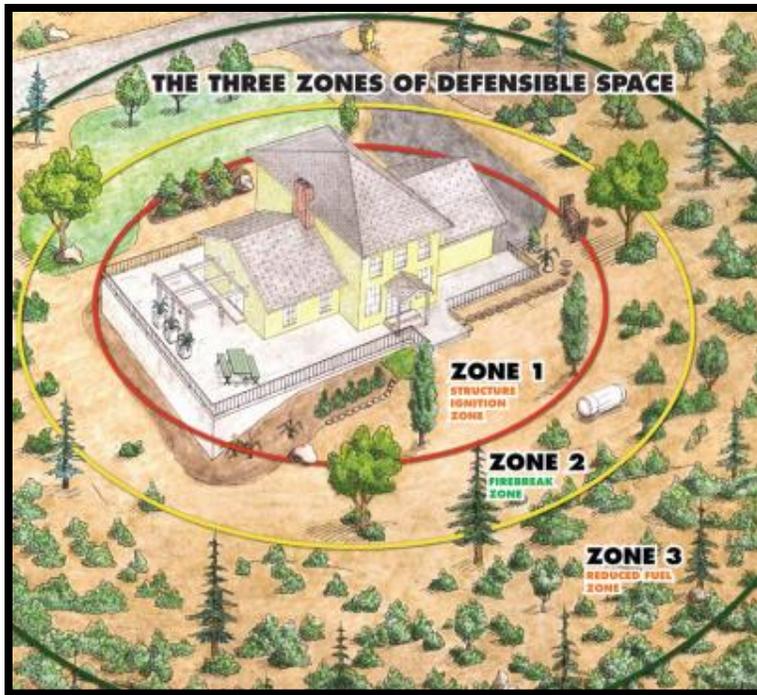


Figure 1: Wildland Urban Interface Zones

*figure not to scale

Short-term effects for all alternatives for the modeled outputs are displayed at five years in the future and mid-term effects are ten years. Modeling indicates that in the long term, 20 years or more in the future, fuels treatments no longer display an effect on reducing fire. Therefore, even though the Silviculture resource report indicates that the project actions will have an effect on stand density for 20 years or more, displaying the results of alternatives on fire and fuels for 20 years or more would not provide meaningful information for comparison of effects on fire hazard and fuel behavior potential.

3.2.4 Affected Environment

As discussed in the Fire and Fuels resource report, management activities, including fire suppression, have resulted in uncharacteristically dense vegetation with high fuel loading and an elevated risk of high-severity, stand-replacing wildfires in the project area. The project area is located in an area of a high concentration of lightning strikes; although numerous fire starts occur in the project area, most of the fires are kept small. The over-accumulation of vegetation and fuel loading due to a lack of disturbance from fire has created conditions that increase the likelihood of larger areas of intense and severe fire (Skinner et al. 2006, Taylor and Skinner 2003, Scott and Reinhardt 2001). Most of the Craggy project area has missed four or more fire return intervals since suppression began on the Forest; eighty percent is moderately or severely departed from historic fire return intervals and 90 percent of the project area has not been burned by wildfire since the 1955 Haystack Fire.

Current concerns focus on high fire hazard (as defined by fuel loading and vegetation densities) and high fire risk (as defined by fire start occurrence) over time. Fire risk and associated fire hazard have led to concerns over fire behavior in and adjacent to private

property and fire effects to resource values on Forest land. In addition, smoke from large fires that does not disperse has the potential to negatively impact the project area which has a high level of human use.

According to the Yreka Area Fire Safe Council's Community Wildfire Protection Plan (Yreka CWPP 2013), more than 80 percent of the fire safe council area is at very high risk of significant damage from wildfire. There are approximately 3,655 landowner parcels within the fire council area. The Craggy project area encompasses portions of this fire safe council area and is aimed at reducing the fire risk as identified within the CWPP on Forest System lands.

3.2.5 Environmental Consequences

Alternative 1

Direct and Indirect Effects in the Project Area and Wildland Urban Interface

Under Alternative 1, there will be no direct effects because proposed treatments will not take place. Fire hazard potential (flame length potential and fire type) and fire effects to vegetation will remain as described in the affected environment.

Without treatment, many stands will continue to have decreasing resilience and increasing susceptibility to wildfire, insects, and disease, while other stands are likely to continue to lose their structural and compositional diversity. Indirectly, this alternative allows the current fuel loading conditions to continue and potentially increase due to tree mortality. As vegetation continues to grow with no management actions and no reduction in fuel loading, an increasing percentage of the project area will gain the potential for high flame lengths which correlates with uncharacteristically high-severity fire. Without strategically placed treatments, there would continue to be a heightened threat to the communities within and adjacent to the project area and within the wildland urban interface.

Cumulative Effects

Other ongoing and reasonably foreseeable actions within the project area, including timber harvest on private land and various fuels treatments on private and public land, will likely decrease the density of trees in the 7th field watersheds. This will reduce ladder fuels, slightly decrease the likelihood of crown fire and flame length potential, and therefore reduce the risk of wildfire to private property and resources. However, adding these effects to Alternative 1 will have less than significant cumulative impacts on the increased fire hazard in the project area and the area within the wildland urban interface over the next 20 years because of the limited scale of these projects.

Alternative 2

Direct and Indirect Effects in the Project Area

Under Alternative 2, 10,600 acres of treatment in the 29,500-acre project area will lead the project area (both in treated areas and in adjacent stands) toward resilient forest conditions. These effects to flame length potential, fire type, and fire behavior on dominant vegetation are displayed in Table 3-1 through Table 3-4.

Table 3-1: Flame Length Potential for the Project Area for Alternative 2 in Acres and Percent of the Project Area

Flame Length	Short-term (5 years) Post-Treatment (percent)	Mid-term (10 years) Post-treatment
0-4 feet	16,329 (55)	11,178 (38)
4-8 feet	6,264 (21)	9,755 (33)
8-11 feet	1,204 (4)	1,718 (5)
Greater than 11 feet	5,884 (20)	7,029 (24)

Table 3-2: Fire Type Potential for the Project Area for Alternative 2 in Acres and Percent of the Project Area

Fire Type	Short-term (5 years) Post-Treatment	Mid-term (10 years) Post-treatment
Surface	22,437 (79)	20,140 (68%)
Passive Crown	4,932 (17)	7,633 (26%)
Active Crown	1,311 (4)	1,908 (6%)

Table 3-3: Fire Behavior Potential on Dominant Vegetation Type for the Project Area for Alternative 2, in Acres

Dominant Vegetation Type	Low (0-4 feet)	Moderate (4-8 feet)	High (8-11 feet)	Very High (greater than 11 feet)
Annual Grass	680	199	5	335
Barren	322	0	0	0
Douglas Fir	2,414	297	70	1,316
Mixed Chaparral	3,269	1,692	113	2,182
Montane Chaparral	926	701	90	1,330
Montane Hardwood Conifer	930	265	37	743
Montane Hardwood	973	598	50	1,090
Montane Riparian	51	16	1	30
Perennial Grass	198	107	2	29
Ponderosa Pine	785	142	33	180
Sagebrush	41	2	1	1
Sierran Mixed Conifer	4,230	830	154	1,690
White Fir	189	38	10	60
Total	15,008	4,887	566	8,986

Table 3-4: Fire Behavior Potential on Size Class for the Project Area for Alternative 2 in Acres

Size Class (diameter in inches)	Low (0-4 feet)	Moderate (4-8 feet)	High (8-11 feet)	Very High (greater than 11 feet)
1-5.9 inches	684	99	1	76
6-10.9 inches	424	200	20	207
11-23.9 inches	3,370	1,037	134	2,090

Size Class (diameter in inches)	Low (0-4 feet)	Moderate (4-8 feet)	High (8-11 feet)	Very High (greater than 11 feet)
Greater than 24 inches	4,645	852	158	2,725
Total	9,123	2,188	313	5,098

After completion of the treatments, 37 percent more (55 percent total) of the project area would have flame lengths less than four feet (specified in the Forest Plan as being the threshold for low fire hazard). Fifteen percent more (79 percent total) of the area would have surface rather than crown fire types. This is important because these flame lengths and fire types allow the use of the most effective strategies for containing wildfires (including direct attack with hand crews).

In fuel breaks and thinning without product removal units where pile burning would occur, fire would be allowed to underburn within the designated unit at low intensity if there is low risk of burning onto private property. Measures will be included in the prescribed burn plan to minimize the risk of fire escaping designated units. This also applies to the wildland urban interface area which is described below.

Direct and Indirect Effects in the Wildland Urban Interface Area

Since the threat zone includes both defense and home ignition zones, the total number of acres of wildland urban interface that would be affected by the project is about 17,260 acres. Under Alternative 2, 10,600 acres of treatment would help to create resilient forest conditions in the wildland urban interface as displayed in Table 3-5 and Table 3-6. Having flame lengths of less than four feet is particularly important in the wildland urban interface to allow direct attack of wildfires. In 71 percent of the home ignition zone, 50 percent of the defense zone, and 50 percent of the threat zone, low flame lengths will be achieved in the short term. Over the mid-term, treatment effectiveness for low flame lengths declines to 55 percent for the home ignition zone, 38 percent for the defense zone, and 39 percent for the threat zone. Due to the Craggy Project focusing primarily on the defense and threat zones (including areas adjacent to private land and to the home ignition zone), this allows work on private lands to build upon the Craggy Project's fuels treatments for community and structure protection from wildfire.

Table 3-5: Short-term Flame Length Potential within the Wildland Urban Interface under Alternative 2

Flame Lengths	Home Ignition Zone (Acres)	Defense Zone (Acres)	Threat Zone (Acres)
Low (0-4 feet)	35	508	8,579
Moderate (4-8 feet)	3	154	2,870
High (8-11 feet)	1	12	330
Very High (greater than 11 feet)	11	361	5,477
Total	49	1,035	17,256

Table 3-6: Mid-term Flame Length Potential within the Wildland Urban Interface under Alternative 2

Flame Lengths	Home Ignition Zone (Acres)	Defense Zone (Acres)	Threat Zone (Acres)
Low (0-4 feet)	27	396	6,685
Moderate (4-8 feet)	12	342	6,625
High (8-11 feet)	1	72	1,051
Very High (greater than 11 feet)	9	225	2,895
Total	49	1,035	17,256

Actions in Alternative 2 provide a substantial benefit to the wildland urban interface by increasing the number of acres in which low and moderate flame lengths are expected to occur and decreasing substantially the number of acres in which high and very high flame lengths are expected. In addition, this would increase firefighter suppression capability within the wildland urban interface which would help decrease the likelihood of structures being damaged or destroyed. Treatments near routes that allow firefighters and the public to enter or leave the project area (ingress and egress), especially roadside fuelbreaks, would provide increased safety for firefighters entering the area and allow for safer evacuation if necessary for the public.

Thinning will increase canopy base heights making it more difficult for fire to get into tree crowns and promoting more surface-fire. Mastication, in units that primarily consist of brush, changes vegetation from standing brush to finer fuels on the surface floor. These treatments lead to decreased likelihood of crown fire types occurring.

Cumulative Effects

Adding the effects of the reasonably foreseeable future fuel reduction treatments displayed in Appendix C to the effects of this alternative will decrease flame lengths and move toward less crown fire where similar treatments are proposed, but will not produce significant cumulative effects. Some future actions such as fuel reduction treatments on the Bureau of Land Management lands, and timber harvest and fuels reduction on private lands, will have some beneficial effects to the project area and wildland urban interface. These projects are anticipated to benefit the analysis indicators as in some locations they tie into work proposed in Alternative 2 and the treatments will complement one another.

Alternative 3

Direct and Indirect Effects in the Project Area

Alternative 3 proposes to treat about 11,310 acres. This alternative has similar effects on flame lengths and fire type to those of Alternative 2 with some differences due to some stands being treated in Alternative 2 that are not treated in Alternative 3, and additional fuels treatments adjacent to private lands in Alternative 3. However, these differences are minor in effects on fire resiliency over the landscape. Effects of Alternative 3 on flame lengths, fire type, type of vegetation, and tree-size classes are displayed in Table 3-7 through Table 3-10.

Table 3-7: Flame Length Potential for the Project Area for Alternative 3 in Acres and Percent of the Project Area

Flame Length	Short-term (5 years) Post-Treatment	Mid-term (10 years) Post-treatment
0-4 feet	17,275 (58%)	16,997 (57%)
4-8 feet	5,704 (19%)	5,969 (20%)
8-11 feet	1,161 (4%)	1,166 (4%)
Greater than 11 feet	5,541 (19%)	5,549 (19%)

Table 3-8: Fire Type Potential for the Project Area for Alternative 3 in Acres and Percent of the Project Area

Fire Type	Short-term (5 years) Post-Treatment	Mid-term (10 years) Post-treatment
Surface	23,605 (80%)	21,107 (71%)
Passive Crown	4,852 (16%)	6,859 (23%)
Active Crown	1,215 (4%)	1,714 (6%)

Table 3-9: Fire Behavior Potential on Dominant Vegetation Type for the Project Area for Alternative 3, in Acres

Dominant Vegetation Type	Low (0-4 feet)	Moderate (4-8 feet)	High (8-11 feet)	Very High (greater than 11 feet)
Annual Grass	774	122	5	319
Barren	322	0	0	0
Douglas Fir	2,513	829	413	342
Mixed Chaparral	3,727	1,313	57	2,159
Montane Chaparral	1,247	921	122	757
Montane Hardwood Conifer	1,080	436	97	362
Montane Hardwood	1,197	682	106	726
Montane Riparian	66	15	0	17
Perennial Grass	252	41	13	30
Ponderosa Pine	878	137	37	88
Sagebrush	43	1	1	0
Sierran Mixed Conifer	4,871	1,026	298	709
White Fir	267	11	8	11
Total	17,237	5,534	1,157	5,520

Table 3-10: Fire Behavior Potential on Size Class for the Project Area for Alternative 3 in Acres

Size Class (diameter in inches)	Low (0-4 feet)	Moderate (4-8 feet)	High (8-11 feet)	Very High (greater than 11feet)
1-5.9 inches	685	116	13	46
6-10.9 inches	510	207	13	121
11-23.9 inches	3,942	1,249	259	1,181

Size Class (diameter in inches)	Low (0-4 feet)	Moderate (4-8 feet)	High (8-11 feet)	Very High (greater than 11feet)
Greater than 24 inches	5,489	1,456	567	868
Total	10,626	3,028	852	2,216

After completion of the treatments, 40 percent more (58 percent total) of the project area would have flame lengths less than four feet, and 16 percent more (80 percent total) of the area would have the surface fire type with this alternative.

Direct and Indirect Effects in the Wildland Urban Interface Area

Under Alternative 3, treatment of 11,310 acres would help to create resilient forest conditions in the wildland urban interface as displayed in Table 3-11 and Table 3-12. As noted for Alternative 2, having flame lengths of less than four feet is particularly important in the wildland urban interface to allow direct attack of wildfires. In 92 percent of the home ignition zone, 75 percent of the defense zone, and 61 percent of the threat zone, flame lengths below four feet would occur in the short term and midterm.

Table 3-11: Short-term Flame Length Potential within the Wildland Urban Interface under Alternative 3

Flame Lengths	Home Ignition Zone (Acres)	Defense Zone (Acres)	Threat Zone (Acres)
Low (0-4 feet)	45	770	10,540
Moderate (4-8 feet)	1	95	3,111
High (8-11 feet)	0	28	722
Very High (greater than 11 feet)	3	142	2,883
Total	49	1,035	17,256

Table 3-12: Mid-term Flame Length Potential within the Wildland Urban Interface under Alternative 3

Flame Lengths	Home Ignition Zone (Acres)	Defense Zone (Acres)	Threat Zone (Acres)
Low (0-4 feet)	43	757	10,406
Moderate (4-8 feet)	3	107	3,238
High (8-11 feet)	0	28	724
Very High (greater than 11 feet)	3	143	2,888
Total	49	1,035	17,256

Cumulative Effects

Adding the effects of the reasonably foreseeable future fuel reduction treatments to the effects of this alternative will be similar to those described for Alternative 2.

3.2.6 Comparison of Alternatives

Alternatives are compared below for the project area and for the wildland urban interface area.

Comparison of Alternatives for the Project Area

Table 3-13 and Table 3-14 (short-term) and Table 3-15 and Table 3-16 (mid-term) compare the potential flame length and fire type for the project area by alternative.

Table 3-13: Flame Length Potential (short-term) in the Project Area for Alternative 1 Compared to Action Alternatives

Flame Length	Alternative 1	Alternative 2	Alternative 3
0-4 feet	5,262 (18%)	16,329 (55%)	17,275 (58%)
4-8 feet	5,497 (19%)	6,264 (21%)	5,704 (19%)
8-11 feet	7,413 (25%)	1,204 (4%)	1,161 (4%)
Greater than 11 feet	11,544 (39%)	5,884 (20%)	5,541 (19%)

Table 3-14: Fire Type Potential (short-term) in the Project Area for Alternative 1 Compared to Action Alternatives

Fire Type	Alternative 1	Alternative 2	Alternative 3
Surface	18,987 (64%)	22,437 (79%)	23,605 (80%)
Passive Crown	8,111 (27%)	4,932 (17%)	4,852 (16%)
Active Crown	2,618 (9%)	1,311 (4%)	1,215 (4%)

Table 3-15: Flame Length Potential (mid-term) in the Project Area for Alternative 1 Compared to Action Alternatives

Flame Length	Alternative 1	Alternative 2	Alternative 3
0-4 feet	5,262 (18%)	11,187 (38%)	16,997 (57%)
4-8 feet	5,497 (19%)	9,755 (33%)	5,969 (20%)
8-11 feet	7,413 (25%)	1,718 (5%)	1,166 (4%)
Greater than 11 feet	11,544 (39%)	7,029 (24%)	5,549 (19%)

Table 3-16: Fire Type Potential (mid-term) in the Project Area for Alternative 1 Compared to Action Alternatives

Fire Type	Alternative 1	Alternative 2	Alternative 3
Surface	18,987 (64%)	20,140 (68%)	21,107 (71%)
Passive Crown	8,111 (27%)	7,633 (26%)	6,859 (23%)
Active Crown	2,618 (9%)	1,708 (6%)	1,714 (6%)

Table 3-17 and Table 3-18 compare the short-term fire behavior potential on dominant vegetation type and size class for the project area under Alternative 1, and for Alternatives 2 and 3.

Table 3-17: Fire Behavior Potential (flame length) on Dominant Vegetation Types in Acres, Comparing Short-term Effects for Alternatives

Alternatives	Alternative 1				Alternative 2				Alternative 3			
	Low (0-4')	Mod. (4-8')	High (8-11')	Very High (> 11')	Low (0-4')	Mod. (4-8')	High (8-11')	Very High (> 11')	Low (0-4')	Mod. (4-8')	High (8-11')	Very High (> 11')
Annual Grass	235	213	216	556	680	199	5	335	774	122	5	319
Barren	322	0	0	0	322	0	0	0	322	0	0	0
Douglas Fir	848	701	982	1,566	2,414	297	70	1,316	2,513	829	413	342
Mixed Chaparral	824	1,867	1,614	2,950	3,269	1,692	113	2,182	3,727	1,313	57	2,159
Montane Chaparral	319	441	937	1,350	926	701	90	1,330	1,247	921	122	757
Montane Hardwood Conifer	324	327	454	870	930	265	37	743	1,080	436	97	362
Montane Hardwood	464	416	746	1,091	973	598	50	1,090	1,197	682	106	726
Montane Riparian	30	24	14	29	51	16	1	30	66	15	0	17
Perennial Grass	80	126	56	74	198	107	2	29	252	41	13	30
Ponderosa Pine	302	279	237	322	785	142	33	180	878	137	37	88
Sagebrush	19	12	7	7	41	2	1	1	43	1	1	0
Sierran Mixed Conifer	1,455	896	1,922	2,633	4,230	830	154	1,690	4,871	1,026	298	709
White Fir	164	43	40	51	189	38	10	60	267	11	8	11
Total	5,386	5,345	7,225	11,499	15,008	4,887	566	8,986	17,237	5,534	1,157	5,520

Table 3-18: Fire Behavior Potential on Vegetation Size Class for Current Condition as Displayed for Alternative 1 Compared to Action Alternatives in the Short Term

Alternatives	Alternative 1				Alternative 2				Alternative 3			
	Low (0-4')	Mod. (4-8')	High (8-11')	Very High (> 11')	Low (0-4')	Mod. (4-8')	High (8-11')	Very High (> 11')	Low (0-4')	Mod. (4-8')	High (8-11')	Very High (> 11')
1-5.9 inches	226	357	154	123	684	99	1	76	685	116	13	46
6-10.9 inches	119	221	222	289	424	200	20	207	510	207	13	121
11-23.9 inches	1,146	1,069	1,842	2,574	3,370	1,037	134	2,090	3,942	1,249	259	1,181
Greater than 24 inches	1,882	1,180	2,074	3,244	4,645	852	158	2,725	5,489	1,456	567	868
Total	3,373	2,827	4,292	6,230	9,123	2,188	313	5,098	10,626	3,028	852	2,216

For the action alternatives, the fuel treatments including re-introducing fire to the project area under prescribed conditions will provide the benefits associated with low- to mixed-severity fires while minimizing the adverse effects often resulting from uncontrolled high-severity wildfires. While Alternative 3 provides more acres of low flame lengths and surface fire type than does Alternative 2, the greatest differences in benefits are between Alternative 1 and the action alternatives.

Comparison of Alternatives for the Wildland Urban Interface

Table 3-19 (short-term) and Table 3-20 (mid-term) compare the flame length potential within the wildland urban interface under the Alternative 1 and post-treatment for action alternatives.

Table 3-19: Flame Length Potential (short-term) in the Wildland Urban Interface for Alternative 1 Compared to Action Alternatives

Alternative	Alternative 1			Alternative 2			Alternative 3		
	Home Ignition Zone (Acres)	Defense Zone (Acres)	Threat Zone (Acres)	Home Ignition Zone (Acres)	Defense Zone (Acres)	Threat Zone (Acres)	Home Ignition Zone (Acres)	Defense Zone (Acres)	Threat Zone (Acres)
Low (0-4')	12	207	2,874	35	508	8,579	45	770	10,540
Moderate (4-8')	6	126	3,183	3	154	2,870	1	95	3,111
High (8-11')	9	297	4,387	1	12	330	0	28	722
Very High (>11')	22	405	6,812	10	361	5,477	3	142	2,883
Total	49	1,035	17,256	49	1,035	17,256	49	1,035	17,256

Table 3-20: Flame Length Potential (mid-term) in the Wildland Urban Interface for Alternative 1 Compared to Action Alternatives

Alternatives	Alternative 1			Alternative 2			Alternative 3		
	Home Ignition Zone (Acres)	Defense Zone (Acres)	Threat Zone (Acres)	Home Ignition Zone (Acres)	Defense Zone (Acres)	Threat Zone (Acres)	Home Ignition Zone (Acres)	Defense Zone (Acres)	Threat Zone (Acres)
Low (0-4')	12	207	2,874	27	396	6,685	43	757	10,406
Moderate (4-8')	6	126	3,183	12	342	6,625	3	107	3,238
High (8-11')	9	297	4,387	1	72	1,051	0	28	724
Very High (>11')	22	405	6,812	19	225	2,895	3	143	2,888
Total	49	1,035	17,256	49	1,035	17,256	49	1,035	17,256

Action alternatives provide a substantial benefit to the wildland urban interface by increasing the number of acres on which low and moderate flame lengths are expected to occur and decreasing substantially the number of acres on which high and very high flame lengths are expected. This will increase firefighter suppression capability within the wildland urban interface and decrease the likelihood in which structures are damaged or destroyed. For the

wildland urban interface, some of the most important work adjacent to homes is currently being planned as noted in Appendix C of this draft environmental impact statement. Combined strategically-placed treatments on both private and public lands would ultimately reduce the probability of devastating effects from wildfire on homes, infrastructure, and resources.

3.2.7 Compliance with law, regulation, policy, and the Forest Plan

All alternatives are consistent with the Forest Plan standards and guidelines related to fire and fuels as noted on the Forest Plan consistency checklist, available on [the Project website](#). All alternatives are also consistent with the law, regulation and policy referenced in the methodology section of the Fire and Fuels Report.

3.3 Silviculture (Vegetation)

3.3.1 Methodology

Field data were collected from a representative sample of forested stands in the project area; these data were analyzed using the Forest Vegetation Simulator (FVS) model to estimate silvicultural conditions and develop silvicultural prescriptions for treatments. Details on methodology, including analysis indicator measurement, are provided in the Silviculture resource report, available on [the Project website](#).

3.3.2 Analysis Indicators and Measures

Forest health and **Forest resilience** are the two analysis indicators for effects of the project on silviculture (vegetation). Forest health is the ability of trees to utilize available water and nutrient resources to grow, increase vigor, and maintain the ability to respond to disturbance mechanisms (avoiding early mortality). Forest resilience is the ability of a stand to successfully resist disturbances.

Forest health is measured by the **stand density index (SDI)**. Stand density index is a method for deriving how site resources in stands are being used and the level of competition in stands for site resources by measuring tree stocking that uses tree size (diameter) and numbers (trees-per-acre). This measure is better for determining density than trees-per-acre or basal area alone.

An SDI of 230 defines the lower threshold for a zone of imminent bark beetle mortality within which endemic populations kill a few trees but net growth is still positive (Oliver 1995). Values over this threshold are indicative of an overly dense stand subject to beetle-induced mortality and subsequent risk of high severity wildfire.

Forest resilience is measured by **heterogeneity** of tree species and composition. Heterogeneity of tree species and composition, or species diversity, increases the likelihood of maintaining sustainable, forested conditions in the event of a number of disturbances such as insect outbreaks or wildfire. For this project, heterogeneity is measured by the modeled number of acres on the landscape that are comprised of multiple species without specifying particular species. Heterogeneity of particular species will be evaluated qualitatively by comparing modeled outcomes of species diversity with the unit-specific written prescriptions.

3.3.3 Spatial and Temporal Bounding of Analysis Area

Spatial bounding is limited to the project area. Silvicultural prescriptions and subsequent analysis are applied specifically to the stands within the project area designated as treatment units; however, due to the homogeneity of the landscape, effects can be generalized to the broader project area.

Temporal bounding for effects extends out to 20 years following inventory conditions. Short-term analysis will be one year after treatment to assess change in stand conditions immediately following implementation. Stand development was modeled for a 20-year period and treatment effects are projected 20 years after the treatment year. That is adequate time in which to display the long-term differences on stand development between treating and not treating stands in the project area. This temporal bound also meets regional forester direction to incorporate treatments that are effective for at least 20 years (USDA 2004b).

3.3.4 Affected Environment

Current stand densities, species composition, and recent droughty conditions have led to a notable increase of beetle-induced mortality in several stands indicating decreased resilience.

About 1,950 acres of the project are comprised of natural stands and about 3,140 acres are in plantations. Both types of stands range in elevation from 2,700 feet to 5,400 feet and are densely stocked averaging 210 trees per acre. In natural stands, Douglas-fir dominates the species composition. There are lesser amounts of ponderosa pine, white fir, sugar pine, and incense cedar as well. The stand density index for these stands currently averages 265 which is over the threshold of an SDI of 230 (Oliver 1995). Some stands on the eastside of the project are composed of primarily Douglas-fir with sugar pine and ponderosa pine in the overstory. These mixed-conifer stands would have a slightly higher SDI threshold (240-330) given the species diversity and the ability of Douglas-fir to persist at higher densities. These stands are included in the average stand density index measures.

Plantation stands were initiated between 1956 and 2011 following the Haystack Fire of 1955. These stands have an average SDI of 245 and are dominated by ponderosa and Jeffrey pines with lesser amounts of Douglas-fir, sugar pine, white fir and incense cedar. Due to current stand densities and droughty condition, western pine beetles have begun killing small (less than a quarter acre) groups of trees with increasing frequency over the last five years in the older planted stands and terraced plantations.

3.3.5 Environmental Consequences

Alternative 1

Direct and Indirect Effects

Conifer density and competition, as measured by stand density index, will continue to increase within stands in the project area from the current value of 265 to 301 after 20 years. This will encourage increasing tree mortality due to insect infestation.

Forest resilience will stagnate as homogenous plantations will continue to occupy most of the landscape with little opportunity for other species, particularly hardwoods, to persist. As conifers grow and shade out hardwood species, heterogeneity is reduced over time.

Cumulative Effects

Since no reasonably foreseeable future actions will occur in this resource's analysis area within the 20-year temporal bounding that will have an effect on the indicators, adding the effects of this alternative to the effects of past and future actions will not produce measureable cumulative effects. The projected stand density index increase to 301 after 20 years of no treatment will not be further influenced by any reasonably foreseeable future actions within the analysis area.

Alternative 2

Direct and Indirect Effects

In general, prescribed treatments are designed to reduce stand density and the potential for extreme fire behavior in order to promote growth and development of stands that are healthier, structurally diverse, and more resilient to insects, disease, and fire. Both types of thinning (thinning with and without product removal) will reduce tree density and the likelihood of western pine beetle outbreaks. This alternative will result in an SDI of 148 in the short term, and 200 in the long term.

According to modeled outcomes, there will be an increase of stand heterogeneity (species diversity) with this alternative. Silvicultural prescriptions address site-specific species preference, including hardwoods, to retain diversity on the landscape. This specification will result in stand heterogeneity where the site is capable of supporting diverse species. Indirect effects of treating stands as described in Alternative 2 will result in the maintenance or enhancement of species diversity where compatible with site conditions.

Cumulative Effects

Past actions are reflected in the discussion of the affected environment. No reasonably foreseeable future actions are expected in treatment areas that would impact forest health and forest resiliency. Adding the beneficial effects on forest health and resiliency of Alternative 2 to the effects of past, present and reasonably foreseeable future actions is not expected to have any additional effects on the measurement indicators.

Alternative 3

Direct and Indirect Effects

The effects of Alternative 3 are the same as those described in Alternative 2 for the stands that are proposed for treatment. Eight stands in this alternative differ in silvicultural prescription from Alternative 2 and will have slightly different effects than Alternative 2. For stands not treated, effects will be the same as Alternative 1.

Five stands (174 acres) would be changed from thinning with product removal to thinning without product removal. Two additional units have a reduction in acres proposed for thinning with product removal (45 acres). Thinning without product removal results in a smaller reduction in the stand density index, which makes this method less effective at increasing stand health and resiliency. Stand density will be reduced below the threshold of concern (SDI of 230) for susceptibility to bark beetles in the short term, but the efficacy of treatment will not make it to the 20 year standard. Although a similar number of acres will be treated in both alternatives, fewer acres will meet the purpose and need for stand resiliency and forest health than in Alternative 2 due to the decrease in acres of thinning with product

removal. The long-term effectiveness of the prescriptions for Alternative 3 treatments is not met on approximately eight percent of the stands. All proposed treatment in this alternative will result in an SDI of 153 in the short term, and 299 in the long term.

Cumulative Effects

Past actions are reflected in the discussion of the affected environment. No reasonably foreseeable future actions are expected in treatment areas that would impact forest health and forest resiliency. Adding the beneficial effects on forest health and resiliency of Alternative 3 to the effects of past, present and reasonably foreseeable future actions is not expected to have any additional effects on the measurement indicators.

3.3.6 Comparison of Alternatives

Alternative 1 would not increase forest health or resilience. Alternative 2 treats the greatest number of acres for forest health and provides the greatest number of acres of forest resilience measured by modeled heterogeneity of tree species. Alternative 2 also includes the larger number of treatments that have a longer period of effectiveness; this is beneficial for getting stands on a trajectory towards the desired conditions which include resilience to insects and disease, resilience to wildfire and improved stand health (reduced stand density to optimize growing conditions). Alternative 3 proposes a similar number of acres for treatment but leaves forest health on many acres of plantations in an overstocked condition (susceptible to beetle outbreaks and advanced mortality) and without improved forest heterogeneity. Alternative 3 would have short-term benefits but would not meet direction for 20-year effectiveness of treatment as displayed in Table 3-21.

Table 3-21: Comparison of Effects on Forest Health (measured by SDI).

Measures	Alternative 1 (affected environment baseline)	Alternative 1 20 years after no treatment	Alternative 2 one year after treatment	Alternative 2 20 years after treatment	Alternative 3 one year after treatment	Alternative 3 20 years after treatment
Stand Density Index	265*	301*	148	200	153	299*

*Above the threshold of concern for susceptibility to insect and disease (230 SDI)

3.3.7 Compliance with law, regulation, policy, and the Forest Plan

All alternatives comply with law, regulation, policy and the Forest Plan as noted in the Forest Plan Consistency Checklist, available on [the Project website](#).

3.4 Botany

This section evaluates the Craggy Project in sufficient detail to determine its effects on federally listed endangered, threatened, proposed, Forest Service sensitive, and survey and manage botanical species, and assess the risk of spread or introduction of non-native invasive plant species. The Craggy Vegetation Management Project Biological Assessment/Biological Evaluation, Survey and Manage Review, Noxious Weed Risk Assessment, and pre-field documents: Appendices A-1, A-2, and A-3 are summarized below, incorporated by reference and available on [the Project website](#) as part of the Botany Resource Report.

3.4.1 Methodology

An office pre-field review was conducted to determine if the project is within the range of any federally listed threatened, endangered, proposed, candidate, sensitive, or survey and manage plant species (collectively the botanical species of concern) for the Klamath National Forest, and if suitable habitat for any species of concern existed in the project area.

Additionally, the review indicated whether any species of concern or invasive plant species were known to be present within the proposed project area (Appendix D of the Botany Resource Report). All species listed for the Forest were considered for this review (USDA and USDI 2001, USDA 2015, and USDI 2017). The Forest Noxious Weed and Non-native Invasive Plant List (Appendix B of the Botany Resource Report) was used for the invasive species review.

3.4.2 Analysis Indicators and Measures

The analysis indicators for measuring the effects of the Craggy Project are based on law, policy, and direction. The significance of management activities upon species of concern and invasive species depends upon many factors; the alternatives are evaluated in terms of how they would affect the analysis indicators for species of concern and non-native invasive species (weeds) using the following indicators.

Threatened and Endangered Species

- Likelihood of jeopardizing the continued existence of threatened, endangered, proposed, or candidate species populations.

Sensitive Species (General)

- Trend of sensitive species population viability measured as increasing, declining, or static.

Sensitive Species (Calochortus persistens) – Analysis indicators specifically for this species are in response to the Conservation Agreement (USDI USDA 2013) that outlines specific management actions to reduce the known threats to this species.

- The maintenance or improvement of habitat conditions within occupied *Calochortus persistens* sites; measured by ground disturbance, the risk of noxious weed introduction or spread, and the level of conifer encroachment.
- The likelihood that a wildfire could be suppressed using minimum suppression techniques within Management Area 5 (*Calochortus persistens*) measured by comparing the fire and fuels Haul Chart⁶ between alternatives.

⁶ The Haul Chart is a table prepared by fire and fuels specialists to display the relationship of flame lengths to suppression techniques.

Survey and Manage Species

- Compliance with survey and manage guidelines as defined by the 2001 Record of Decision (USDA and USDI 2001).

Non-native Invasive Plant Species

- Risk of introducing or spreading non-native invasive species measured by a rating of high, moderate, or low risk (this indicator will be measured separately within Management Area 5).

Assumptions Specific to Species of Concern and Invasive Species

Species of Concern: Survey and manage guidelines will be used to analyze effects on botanical species that fall under both sensitive and survey and manage categories because they provide for a more protective management strategy.

Invasive Species: Not all existing weed infestations are currently mapped. It is assumed that high priority weed species in this project area have been discovered and mapped through the noxious weed program and project specific survey. There are, however, large infestations of low and moderate priority species that are not mapped within the project area; roadside weed infestations that are low or moderate priority species in this project area are expected to continue to spread along road systems regardless of project activities. Inclusions of privately owned lands within the project boundary may contain infestations of weeds that could spread to National Forest System lands regardless of Forest activities and once established, weed infestations are likely to persist long term.

3.4.3 Spatial and Temporal Context

The analysis area for botanical species of concern and non-native invasive species is the project area because it is the most relevant to changes to population viability and the risk of spread from project activities. The temporal bounding for botanical species of concern and non-native invasive species will be less than five years for short-term and greater than five years for long-term effects. The temporal bounding was chosen to account for species recovery times, seed dormancy and germination requirements, and the difficulty of identifying biennial and perennial vegetative life stages (rosettes).

3.4.4 Affected Environment

Threatened and Endangered Species

The preliminary botanical field review determined that this project is not within the range or habitat for the federally listed species *Astragalus applegatei*, *Fritillaria gentneri*, *Chamaesyce hooveri*, *Pinus albicaulis*, or *Orcuttia tenuis*. The Project is within range and contains potentially suitable habitat for *Phlox hirsuta*. Project surveys specifically designed to target *Phlox hirsuta* resulted in no additional populations discovered (for details see the field survey section in the Biological Evaluation in the Botany Resource Report). There are no documented populations of *Phlox hirsuta* within any proposed Project activities. Field surveys conducted for the Craggy Vegetation Management Project were adequate to determine presence of threatened, endangered, and proposed botanical species.

Sensitive Species

The proposed project area was determined to contain documented occurrences or suitable habitat for the following species listed in Table 3-22 below.

Table 3-22: Documented Occurrences or Suitable Habitat for Sensitive Plant Species

SPECIES	CODE	STATUS	FIELD SURVEY RECOMMENDED
<u>Known Occurrences</u>			
<i>Calochortus persistens</i>	CAPE	Sensitive	Yes
<i>Eriogonum ursinum var. erubescens</i>	ERURE	Sensitive	Yes
<u>Suitable Habitat</u>			
<i>Cypripedium fasciculatum</i>	CYFA	Sensitive/Survey & Manage – Vascular	Yes – low probability in project area; but survey recommended.
<i>Cypripedium montanum</i>	CYMO2	Sensitive/Survey & Manage – Vascular	Yes – low probability in project area; but survey recommended.

Project specific surveys were conducted in September of 2010; April, May, July, and August of 2011, and May of 2013. These surveys were in addition to past field work for other projects that also located sensitive plants. All field surveys were performed at a time appropriate to make positive identifications of plant species of concern. Surveys were intuitively controlled; only project activity areas with suitable habitat were surveyed for the target species (CAPE, ERURE, CYFA, and CYMO2). Previously documented populations of *Calochortus persistens* and *Eriogonum ursinum var. erubescens* were relocated during project specific surveys.

As a result of field surveys no new locations of any sensitive species were discovered. Species that were not located during survey for this project will not be addressed further in this document; the species that are addressed further in this document are: *Calochortus persistens* and *Eriogonum ursinum var. erubescens*.

The trend of sensitive species population viability: Populations of *Calochortus persistens* within the Craggy Vegetation Management Project area are currently viable. The trend is somewhat difficult to estimate because there appears to be great yearly variation in numbers of plants in each population. However, based on recent observations the sub-populations within the project area appear to be static. Threats to *Calochortus persistens* including competition from trees, shrubs, and invasive species are present within and adjacent to populations within the analysis area. Populations of *Eriogonum ursinum var. erubescens* within the Craggy Vegetation Management Project area are currently static, there are no threats currently observed to these species within the analysis area.

The maintenance or improvement of habitat conditions within occupied *Calochortus persistens* sites: The habitat for the nine sub-populations along the Gunsight-Humbug Ridge is in functioning condition. There is little ground disturbance occurring within these populations. The main threats to the condition of the habitat comes from conifer encroachment and competition from non-native invasive species. Conifer encroachment has been observed in a number of sub-populations along the Gunsight-Humbug Ridgeline; the removal of this encroachment would improve the habitat condition of each site. Currently Dyer's woad, an invasive species, occurs throughout the area; the competition from this

invasive species is undesirable within the sub-populations. Current management efforts are reducing the amount of competition from Dyer's woad in the Management Area.

The likelihood that a wildfire could be suppressed using minimum suppression techniques within Management Area 5: As described in Table 3-23 below, approximately 60 percent of the Management Area 5 would currently require suppression tactics that require some use of machinery and significant soil disturbing activities, should a wildfire occur in the area.

Table 3-23: Current Flame Length Potential of Management Area 5 with Acres and Percent of the Management Area

Flame Length	Short-term (Current Condition)
0 to 4 feet	376 (40%)
4 to 8 feet	140 (15%)
8 to 11 feet	160 (17%)
greater than 11 feet	270 (28%)

Survey and Manage Species

The pre-disturbance surveys and review of known sites resulted in no populations of any survey and manage botanical species discovered within the project area. During field review it was determined that there was a low likelihood of finding any of these species due to the habitat that exists in the project area. There are no stands that are old enough and contain the habitat characteristics required for the survey and manage botanical species.

Non-native Invasive Species

The Klamath National Forest has a list of noxious and non-native invasive plants that are a concern on the Forest (Appendix B of the Botany Resource Report). A high priority weed species is one that is of important local management concern because it has a limited distribution on the Forest, highly invasive nature, and demonstrated potential to displace large geographic areas of native plant communities. Emphasis for inventory and treatment is given primarily to high priority weed species. Low and moderate priority species are of lesser concern and may be addressed in a project if those species are a priority locally. Priority for treatment is also given geographically, and can include high, medium, and low priority species if they occur in areas that are subject to high probability of dispersal, or are vulnerable to invasion.

The high level of infestation within this project area is primarily due to the high level of recreational use and a long history of disturbance. The non-native invasive species that are documented in the project area are: lens-podded white top (*Cardaria chalapensis*), white top (*Cardaria draba*), spotted knapweed (*Centaurea maculosa*), yellow star thistle (*Centaurea solstitialis*), squarrose knapweed (*Centaurea squarrosa*), Canada thistle (*Cirsium arvense*), Scotch broom (*Cytisus scoparius*), Dyer's woad (*Isatis tinctoria*), and sulphur cinquefoil (*Potentilla recta*). There is currently a **high** risk of weed spread or introduction in the project area due to non-project dependent vectors. The risk of weed spread or introduction is reduced within Management Area 5 due to continuing efforts to control non-native invasive species infestations within the Management Area.

3.4.5 Environmental Effects

Alternative 1

Direct and Indirect Effects

Threatened and Endangered Species

No populations of federally listed threatened, endangered, proposed, or candidate botanical species have been recorded either from previous surveys or surveys specifically for this project. Therefore, there will be no direct, indirect, or cumulative effects to these species. Additionally, there are no activities that are interrelated or interdependent to the proposed action that will affect these species.

Sensitive Species

Under Alternative 1 (no action alternative), there would be no direct effects to sensitive plant species in the project area because there would be no implementation of the proposed activities or associated actions. Indirect effects to sensitive plant species would occur in the form of continued threats to sensitive plant species habitat including conifer and shrub encroachment and competition from non-native and invasive plant species. Wildfire suppression leads to continued fuels buildup until an uncontrolled burn takes place despite the best efforts of suppression crews to stop it. Such an event would have a high likelihood of having a severe negative impact to *Calochortus persistens* and *Eriogonum ursinum* var. *erubescens* habitat. There would be no management in the project area to reduce the likelihood of high intensity wildfire and more aggressive suppression tactics would likely take place in the event of a wildfire.

Survey and Manage Species

Under Alternative 1 there will be no direct or indirect effects because there are no known populations of survey and manage plant species within the Craggy project area from management activities; Alternative 1 is therefore in compliance with the survey and manage direction.

Non-native Invasive Species

Under Alternative 1 there will be no direct introduction of new weed species or spread of existing weed species infestations from project activities. The risk of spread and introduction of weed species in the project area would remain **high** under this alternative due to non-project dependent vectors. Management efforts to control non-native invasive species within Management Area 5 would continue to reduce the risk within this portion of the project area.

Cumulative Effects

There will be indirect effects to sensitive plant habitat under the no action alternative because conifer encroachment will continue to occur and fuels reduction would not occur. However, there are no reasonably foreseeable future actions proposed in the locations where sensitive plants occur to cumulatively add to these indirect effects. There will be no cumulative effects to survey and manage plant species from the no action alternative because there are no direct or indirect effects on these species. The risk of introducing or spreading weeds is unchanged under the no action alternative. Ongoing and future actions within the project area could continue to introduce and spread noxious weeds species, so the risk of weed spread and

introduction in the project area remains **high** when considering all actions for cumulative effects (See Appendix C for the list of actions considered for cumulative effects).

Alternatives 2 and 3

Alternatives 2 and 3 will be analyzed jointly for the effects to sensitive plant species of concern, since the proposed treatment effects to sensitive plant species is the same between Alternatives 2 and 3. Alternative 3 has more acres of fuel breaks (790 acres) and prescribed underburning (270 acres) incorporated into the prescription than Alternative 2, but not enough difference to be analyzed individually for effects to sensitive plant species of concern, this is primarily because the added acres are not within areas where sensitive plant species occur.

Direct and Indirect Effects

Threatened and Endangered Species

No populations of federally listed threatened, endangered, proposed, or candidate plant species have been recorded in botanical records or identified in previous surveys within the Craggy Project area. Therefore, there will be no direct, indirect, or cumulative effects to these species.

Sensitive Species

Alternatives 2 and 3 incorporate actions that would help to address threats to *Calochortus persistens* while incorporating project design features to reduce the threat of further invasion from non-native invasive species. Thinning vegetation in the special habitat management area outside of the *Calochortus persistens* population boundaries would reduce fuels so that the threat of high intensity wildfire would be reduced and the need for heavy fire suppression tactics would not be needed or could be reduced should a fire occur. Furthermore, Alternatives 2 and 3 meet the purpose and need to address known and potential threats to the sensitive plant species *Calochortus persistens* in order to maintain habitat so that random natural events and environmental variation can occur without a negative effect on the future viability of the species. There will be no direct effects to the sensitive plant species *Eriogonum ursinum* var. *erubescens* as a result of Alternative 2 or 3 because of project design features that specify complete project avoidance within these populations.

Analysis Indicators for Alternatives 2 and 3:

- **The trend of sensitive species population viability:** Alternatives 2 and 3 meet the purpose and need to address known and potential threats to the sensitive plant species *Calochortus persistens* in order to maintain habitat so that random natural events and environmental variation can occur without a negative effect on the future viability of the species. *Eriogonum ursinum* var. *erubescens* populations within the project area will remain viable because direct disturbances to these populations will be avoided with the implementation of the project design features; these populations are expected to remain static after implementation of either Alternative 2 or 3.
- **The maintenance or improvement of habitat conditions within occupied *Calochortus persistens* sites:** Reducing conifer and shrub encroachment within two subpopulations of *Calochortus persistens* by hand cutting would improve habitat and provide an opportunity for monitoring the plant response to this kind of activity. This

work would create a small amount of ground disturbance that may cause direct effects to a few individuals. These effects are unlikely to kill individual plants because of the deep seated bulb and the project design feature that specifies this work to be completed during the dormant season.

- **The likelihood that a wildfire could be suppressed using minimum suppression techniques within Management Area 5:** Flame lengths greater than four feet typically create a need for greater fire suppression forces as well as the need for equipment and aircraft in order to suppress the fire. Table 3-24 below shows the benefits of implementing Alternative 2 or 3 compared to Alternative 1 (no action) within the management area for *Calochortus persistens*. Implementing Alternative 2 or 3 increases the acres in the zero to four foot flame length category from 376 acres to 757 acres which is about 80 percent of Management Area 5. The action alternatives greatly reduce the need for fire suppression tactics such as dozers from 60 percent as shown in the no action alternative above to 20 percent.

Table 3-24: Flame Length Potential of Management Area 5 for Alternatives 2 and 3 with Acres and Percent of the Management Area

Flame Length	Short-term Post-Treatment (%)	Mid-term Post-treatment (%)
0 to 4 feet	757 (80)	626 (66)
4 to 8 feet	91 (10)	209 (22)
8 to 11 feet	18 (2)	18 (02)
greater than 11 feet	79 (8)	92 (10)

Survey and Manage Species

Under Alternatives 2 and 3 there will be no direct or indirect effects because there are no known populations of survey and manage plant species within the Craggy Vegetation Management Project area; Alternatives 2 and 3 are therefore in compliance with the survey and manage direction.

Non-native Invasive Species

Overall, there would be a **moderate** risk of introduction or spread of non-native and invasive plant species as a result of habitat alteration and increased vectors as a result of project implementation of either Alternative 2 or 3. When combined with the baseline pre-project risk rating the risk of introduction or spread due to Alternative 2 or 3 is **high** due to the non-project dependent vectors that exist in this project area. Within Management Area 5 this risk is greatly reduced because the activities that are proposed (fuelbreaks, underburn, and skyline harvest) have lower risk ratings associated with weed spread than other proposed activities such as tractor harvest. Additionally, no new landing construction or new temporary road construction would occur within the management area. This risk is even further reduced in Management Area 5 due to the extensive monitoring and treatment that occurs and will continue to occur as part of the Forest Noxious Weed Program. Considering these factors and the effectiveness of the proposed project design features, the risk of introduction and spread specifically within the Management Area for *Calochortus persistens* is **low**.

Cumulative Effects

There is the potential for minor direct and indirect effects to occur to sensitive plant species as a result of implementing Alternative 2 or 3. There are no current plans to conduct vegetation management activities in this area beyond the scope of this project in the near future on Forest lands. There is the potential for timber harvesting to occur on private land, however, this does not overlap with any locations of sensitive plants within the project area. Therefore, this project, foreseeable future projects, and those that have occurred in the recent past, are not likely to contribute any cumulative adverse effects to sensitive plant species or habitat. There will be no cumulative effects to survey and manage plant species from Alternative 2 or 3 because there are no direct or indirect effects to these species. Introduction of new weeds through natural processes such as wind, water, and wildlife would proceed unchanged in Alternative 2 or 3. New weed sites may still be introduced through recreational vehicular use or livestock use of the project area. Any future projects proposed by the Forest in this project area would include project design features to reduce the risk of introduction or spread of noxious weeds. Future projects in this area on private land have a high risk of introducing or spreading noxious weeds into the project area because it is unknown how or if mitigation measures would be applied to reduce this risk. High priority weed species would be detected and treated through the Forest Noxious Weed Program. Overall, when project design features are applied, there would be a **moderate** potential risk for cumulative effects.

Determination of Effects

Threatened and Endangered Species

*The Craggy Vegetation Management Project will not affect *Astragalus applegatei*, *Pinus albicaulis*, *Fritillaria gentneri*, *Phlox hirsuta*, *Chamaesyce hooveri*, or *Orcuttia tenuis*.*

Sensitive Species

*Under all alternatives, the Craggy Vegetation Management Project may affect individuals, but is unlikely to result in a trend toward federal listing or a loss of viability for the sensitive plant species *Calochortus persistens* and *Eriogonum ursinum* var. *erubescens*.*

Survey and Manage Species

Under all alternatives, The Craggy Vegetation Management Project will comply with survey and manage regulations.

3.4.6 Comparison of Alternatives

Table 3-25 below displays a comparison of effects to botanical resources between alternatives as compared using the analysis indicators.

Table 3-25: Comparison of Effects to Botanical Resources between Alternatives

Analysis Indicator	Alternative 1	Alternatives 2 and 3
Likelihood of jeopardizing the continued existence of threatened, endangered, proposed, or candidate species populations.	No direct, indirect, or cumulative effects to any threatened, endangered, proposed, or candidate plant species.	No direct, indirect, or cumulative effects to any threatened, endangered, proposed, or candidate plant species.
The trend of sensitive species population viability	No direct effects; potential for indirect effects with continued risk of stand replacing wildfire.	Meets the purpose and need to address known and potential threats to the sensitive plant species. Maintains habitat so that random natural events and environmental variation can occur without a negative effect on the future viability of the species.
The maintenance or improvement of habitat conditions within occupied <i>Calochortus persistens</i> sites	No direct effects; indirect effect from continued level of conifer encroachment. This can negatively affect populations because there is more competition for space, water, and nutrients.	Reduces conifer and shrub encroachment within two subpopulations of <i>Calochortus persistens</i> by hand cutting. This would improve habitat and provide an opportunity for monitoring the plant response to this kind of activity.
The likelihood that a wildfire could be suppressed using minimum suppression techniques within Management Area 5	No direct effects; indirect effects if a wildfire were to occur. At least 60% of the Management Area would require more than hand tools to suppress a fire under current modeled conditions. Fire suppression ground-disturbing activities, such as using bulldozers, can have negative impacts to <i>Calochortus persistens</i> .	Implementing Alternative 2 or 3 would increase the acres in the 0 to 4 foot flame length category from 376 acres to 757 acres which is about 80% of the Management Area. This alternative greatly reduces the need for fire suppression tactics such as using bulldozers from 60% as shown in the no action alternative to 20%.
Compliance with survey and manage guidelines for botanical species	Complies	Complies
Risk of introducing or spreading non-native invasive species measured by a rating of high, moderate, or low risk.	High risk of introduction or spread of non-native invasive plant species due to non-project dependent vectors. Risk is reduced within Management Area 5 due to ongoing control efforts.	High risk of introduction or spread of non-native invasive plant species due to non-project dependent vectors. Project design features reduce the risk of introduction or spread due to Project activities. The risk is reduced within Management Area 5 due to ongoing control efforts and additional project design features.

3.4.7 Compliance with Law, Regulation, Policy, and the Forest Plan

Threatened, Endangered, and Sensitive Botanical Species

The Craggy Project complies with section 7 of the Endangered Species Act of 1973 as amended, and Forest Service Policy (FSM 2670). The Project will not affect any threatened, endangered, proposed, or candidate botanical species.

Survey and Manage Botanical Species

The Craggy Project complies with the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other

Mitigation Measure Standards and Guidelines, by assessing the project area and determining that there is no habitat or known sites of survey and manage plant species or fungi that will be affected by the project.

Non-native Invasive Species

The Craggy Project complies with Forest Service Manual 2900 and Forest Plan standards and guidelines require that all projects be evaluated for the risk of noxious weed introduction and spread as a result of project activities. In addition, projects must be designed to reduce the risk of weed introduction or spread. In the action alternatives, project design features have been incorporated which are expected to reduce the risk of weed introduction or spread. Forest Plan standards and guidelines and Forest Service Manual direction will be met.

3.5 Wildlife (Terrestrial)

3.5.1 Methodology

For all terrestrial wildlife species that are federally-listed as threatened or endangered (or proposed for listing), Forest Service sensitive, survey and manage, and management indicator species, analysis indicators include the effects to habitat (quantified by acres affected) or to individuals if known.

3.5.2 Analysis Indicators and Measures

Threatened and endangered species (northern spotted owl) and critical habitat

Analysis indicators for determining effects to the northern spotted owl are acres of nesting and roosting or foraging habitat maintained or improved, degraded, downgraded, or removed. Effects to habitat are described as either no effect, degraded, downgraded, or removed. **No effect** means that the action will not measurably affect the quality of habitat. **Degrade** signifies that treatments have a negative influence on the quality of habitat due to the removal or reduction of northern spotted owl habitat elements but not to the degree where existing habitat function is changed. **Downgrade** applies to treatments that reduce habitat elements to the degree that the habitat will not function in the capacity that exists pre-treatment but activities will not remove habitat entirely (i.e., downgrade from nesting or roosting to foraging habitat). **Removal** pertains to treatments that reduce habitat elements to the degree that habitat will no longer function as suitable for northern spotted owl. Qualitative and quantitative attributes were considered in this process including the anticipated change in habitat structure after treatment. Forest Vegetation Simulator (FVS) modeling predictions were used in combination with considerations of the size of parcel treated, homogeneity of the stand conditions pre- and post-treatment, adjacent habitat conditions, slope position and aspect of parcel to be treated, distribution of untreated riparian areas, and the distribution of leave areas retained. The combination of these factors was considered in the determination of degrading, downgrading, or removal of habitat conditions predicted after treatment.

Northern spotted owl is the only federally-listed species known to exist in the project and analysis area. Effects to critical habitat for the northern spotted owl will also be indicated as number of acres of habitat affected. Habitat for the gray wolf, an endangered species, is

available in the project and analysis area but there is no known sighting of the wolf. Therefore, acres of effects to wolf habitat will not be included as an analysis indicator. Project design features will provide protection to the wolf if it is sighted in the area. The North American wolverine is a species currently proposed for listing as threatened; since this species is also on the Forest Service sensitive list, effects to it and its habitat are disclosed under the Forest Service sensitive section of this chapter.

Forest Service Sensitive, Survey and Manage, Management Indicator Species, and Migratory Birds

Forest Service sensitive species are identified as such by the Pacific Southwest Regional Forester; effects to these species are disclosed in this section of the environmental impact statement. Additional information is available in the Terrestrial Wildlife Biological Evaluation.

Analysis indicators for sensitive species will be acres of habitat maintained or improved, degraded, and removed or lost. Management indicator species are identified in the Forest Plan; effects to these species are disclosed in this section of the environmental impact statement and as part of the Management Indicator Species Report, Parts I and II. Analysis indicators for management indicator species will be acres of habitat maintained or improved and acres lost. For survey and manage species the analysis indicator is compliance with survey and manage direction. Compliance is determined through following the guidance for survey protocols and protection of known sites (USDA USDI 2001). Information on all of these species, plus migratory birds and survey and manage species, and methodology used for this analysis are included in the Wildlife Resource Report and detailed in separate reports. All of these reports are incorporated by reference and are available on [the Project website](#).

3.5.3 Spatial and Temporal Context

The analysis area for effects on wildlife varies by species and reflects the area within which the species could be directly or indirectly affected by the proposed Project.

Northern spotted owl and its critical habitat

The analysis area consists of the project area plus a distance representing a median home range in the California Klamath Province. The project area is defined in chapter 1 of this document. The analysis area was established by a 1.3-mile buffer around treatment units plus all northern spotted owl home ranges that intersect the treatment unit buffers. For this project, the analysis area includes about 57,300 acres, of which about 39,000 are acres managed by the Forest. The treatment area is the area in which actions will occur (about 10,600 to 11,310 Forest acres, depending on the alternative being analyzed). The short-term temporal bound is the time during implementation (about five years). Temporal bounds for long-term effects are up to 30 years following implementation.

Forest Service Sensitive, Survey and Manage, Management Indicator Species, and Migratory Birds

For species with larger home ranges such as wolverine, fisher, or goshawk, the analysis area consists of the project area plus a distance representing a median home range in the California Klamath Province. For other species, the analysis area consists of the area of

potential treatment. The short-term temporal bound is the time during implementation (about five years). Temporal bounds for long-term effects are up to 30 years following implementation.

3.5.4 Affected Environment

Federally-listed as threatened or endangered, or proposed for federally-listing

Northern Spotted Owl

One federally-listed threatened species, the northern spotted owl, is known to occur within the analysis area. The critical habitat (revised) for the northern spotted owl was designated on December 4, 2012. Although habitat can and does occur on private land, critical habitat is only on federally-managed land. The following table displays the amount and type of northern spotted owl habitat that exists in the Craggy analysis area. As noted, there are no acres of nesting or roosting habitat in the analysis area. The “suitable habitat” for this analysis area is all foraging habitat (although dispersal habitat is useful to the owl for moving through the area, dispersal habitat is not considered as suitable habitat by definition).

Table 3-26: Northern Spotted Owl Habitat Acres within the Analysis Area

Northern Spotted Owl Habitat in Analysis Area	Acres of Habitat (acres managed by the Forest)	Acres of Critical Habitat
Non-habitat	44,350 (29,200)	1,890
Dispersal	10,150 (8,010)	1,580
Foraging	2,790 (1,870)	970
Nesting and Roosting	0 (0)	0
Grand Total	57,300 (39,000)	4,440

Table 3-27: Northern Spotted Owl Survey Summary by Activity Centers in the Analysis Area

Activity Center Number	Activity Center Name	Historical Status	Recent Survey Status 2011 through 2015
KL0268	Clear Creek	Non-Reproductive Pair 1992 and 1998; Single 2001	No Response 2011-2017
KL0382	Deadwood	Reproductive Pair 2001; Single 2003	No Response 2011-2016 Single Male 2017
KL4103	Deadwood Baldy	Reproductive Pair 1992	No response 2011-2017

Table 3-28: Home Range and Core Acres of Northern Spotted Owl Activity Centers

Activity Center Number	Activity Center Name	Core Area (0.5 mi Radius)			Home Range (entire 1.3 mi Radius, includes the acres in the core)		
		Nesting and Roosting	Foraging	Total	Nesting and Roosting	Foraging	Total
KL0268	Clear Creek	0	112	112	0	210	210
KL0382	Deadwood	0	44	44	0	159	159

Activity Center Number	Activity Center Name	Core Area (0.5 mi Radius)			Home Range (entire 1.3 mi Radius, includes the acres in the core)		
		Nesting and Roosting	Foraging	Total	Nesting and Roosting	Foraging	Total
KL4104	Deadwood Baldy	0	106	106	0	295	295

Gray Wolf

There are no recorded gray wolf den sites and no rendezvous sites within the Craggy Project analysis area, despite many reported observations of wolves in recent years made to the California Department of Fish and Wildlife. The likelihood of wolves persisting in the analysis area is low because of high road densities and concentrated human use. The area is also close to the community of Yreka, California and has relatively high use (compared to other areas of the Forest) by hunters, off-highway vehicle users, and woodcutters. There is evidence that OR-7 passed through a portion of the planning area in the spring of 2013.

North American Wolverine

No den sites for wolverines are known in the Craggy analysis area although there are ten documented detections on the Forest. Surveys for wolverines have not been conducted within the analysis area. Sightings of this species are rare in Northern California but some sightings have occurred from Del Norte and Trinity Counties east through Siskiyou and Shasta Counties. Habitat distribution in California is poorly known for the North Coast. In northern California, wolverines range from 500-1,500 meters in elevation (1,600 to 4,800 feet) in Douglas-fir and mixed conifer and true fir habitats (Zeiner et al. 1990). Camera stations and track plate surveys have been conducted on the Forest but these surveys did not find wolverines.

Species that are Federally-listed or Proposed, Sensitive, or Survey and Manage

Habitat conditions for species known to exist in the project area or species for which habitat occurs (for federally-listed and proposed species, Forest Service sensitive species, and survey and manage species) are provided in the following table.

Table 3-29: Status, Habitat Description and Known Sites for Terrestrial Species

Species	Status	Known to Occur in Analysis Area	General Habitat Description
Northern spotted owl	Federally- listed as Threatened	Known territories and designated critical habitat.	Nests in complex forested habitats with multi-layered canopies, large overstory trees, snags, and downed wood
North American wolverine	Proposed for federal listing and Forest Service Sensitive	No known locations but species could occur based on available habitat.	Uses meadows, forests, riparian habitats and montane chaparral; mature, structurally complex high elevation conifer and mixed conifer-hardwood forests

Species	Status	Known to Occur in Analysis Area	General Habitat Description
Bald eagle	Forest Service Sensitive	No known nest sites but have been observed roosting and foraging along the Klamath River.	Nests in conifer forests containing old-growth components typically within one mile of water
Northern goshawk	Forest Service Sensitive	One designated goshawk management area. No known nest sites.	Nests in dense, mid-mature and late successional conifer forests
Great Gray Owl	Forest Service Sensitive	Habitat above 5,000 elevation occurs in analysis area. No known nest sites.	Nests in dense mid mature and late successional conifer forests in high elevations with proximity to meadows and openings
Willow flycatcher	Forest Service Sensitive	No known locations but small areas of potential riparian habitat occur along Klamath River.	Nests in river valleys or lush meadows in willows or other riparian tree/shrub species
Fisher	Forest Service Sensitive	Known incidental locations and species could occur based on available habitat.	Mature, structurally complex conifer and mixed conifer-hardwood forests; requires multiple rest sites that are often tree cavities, squirrel/raptor nests, mistletoe platforms or brush piles
Pacific marten	Forest Service Sensitive	No known locations but species could occur at higher elevations of the project.	High-elevation true fir stands; use large logs, snags and live trees for denning/resting
Pallid bat	Forest Service Sensitive	No known locations, but occurrence is likely based on available snag habitat; large rocky outcrops, caves or mines are not known within or adjacent to the project.	Utilizes a variety of arid and or wooded habitats often in association with caves for roosting; will use caves, large trees, mines, buildings and bridges for roosting
Townsend's big-eared bat	Forest Service Sensitive	No known locations, but occurrence is likely based on available snag habitat; caves or mines are not known within or adjacent to the project.	Variety of wooded habitat often in association with caves for roosting; will use caves, large trees, mines, buildings and bridges for roosting
Fringed Myotis bat	Forest Service Sensitive	No known locations, but occurrence is likely based on available snag habitat; large rocky outcrops, caves or mines are not known within or adjacent to the project.	Utilizes a variety of arid and or wooded habitats often in association with caves for roosting; will use caves, large trees, mines, buildings and bridges for roosting
Foothill yellow-legged frog	Forest Service Sensitive	No known locations but potential habitat occurs along tributaries of the Klamath River.	Shallow, slow moving streams with gravel or rocky substrate
Cascade frog	Forest Service Sensitive	No known locations in higher elevations but potential habitat occurs along tributaries of the Klamath River.	Higher elevation lakes and tributaries

Species	Status	Known to Occur in Analysis Area	General Habitat Description
Western bumble bee	Forest Service Sensitive	No known locations. Potential habitat in higher elevations of analysis area.	Open wet meadow habitats
Tehama chaparral snail	Forest Service Sensitive and Survey and Manage (Category A)	One known location but potential habitat may occur in the analysis area	Talus and outcrops within mature conifer forests
Klamath shoulderband (Trinity shoulderband)	Survey and Manage (Category A)	Three known sites in the analysis area.	Closed canopy, moist forest typically near talus refugia
Siskiyou Mountain Salamander	Forest Service Sensitive and Survey and Manage (Category A)	No known sites in analysis area.	Moist forest typically near talus refugia
Scott Bar Salamander	Survey and Manage (Category A)	No known sites in analysis area.	Moist forest typically near talus refugia
Blue-gray tail dropper	Survey and Manage (Category A)	No known locations but potential habitat occurs in the analysis area.	Moist conifer and mixed conifer and hardwood forests high levels of shade and moisture

Management Indicator Species

Additional information on terrestrial management indicator species and their associations that exist in the project area and may be affected by the project is provided in the Wildlife Resource Report. Information on river and stream species and their associations is provided in the Aquatic Resources Report. Information on both is also provided in the Management Indicator Species Report, Parts I and II. A summary is provided on the following table.

Table 3-30: Management Indicator Species Relevant to the Craggy Project

Species	Habitat Association	Habitat Description	Reasons for Selection as a Management Indicator Species
Rainbow Trout	River/ Stream	Cool, clear, fast-flowing permanent streams and rivers	Indicator for water quality, in-stream woody debris, bottom substrate, flows and channel condition.
Steelhead	River/ Stream	Cool, clear, fast-flowing permanent streams and rivers with opportunities to migrate to and from estuaries and ocean habitats	Indicator for water quality, in-stream woody debris, bottom substrate, flows and channel condition.
Tailed frog	River/ Stream	Perennial montane streams with dense vegetation	Indicator for water quality, in-stream woody debris, bottom substrate, flows and channel condition.

American dipper	River/ Stream	Cold, swift, perennial streams	Indicator for water quality, instream woody debris, bottom substrate and flows.
Northern water shrew	River/ Stream	Riparian w/dense grass-forb cover	Indicator of riparian vegetation including canopy, deciduous vegetation, and grass/forb.
Red-breasted sapsucker	Snag-dependent	Mid-to-late seral mixed conifer and riparian deciduous vegetation.	This species is an Indicator of snags as a habitat element and of other species which depend on sap wells.
White-headed woodpecker	Snag-dependent	Ponderosa pine and high elevation mixed-conifer	This species is an Indicator of snags as a habitat element and for other species which depend on woodpeckers for cavities or as prey.
Vaux's swift	Snag-dependent	Late-successional forests with large hollow snags	Indicator of large snags as a habitat element.
Hairy woodpecker	Snag-dependent	Riparian deciduous habitats with large trees for cavities	Indicator of snags as a habitat element and for other species which depend on woodpeckers for cavities or as prey.
Downy woodpecker	Snag-dependent	Riparian deciduous habitats with large trees for cavities	Indicator of snags as a habitat element and for other species which depend on woodpeckers for cavities or as prey.
Pileated woodpecker	Snag-dependent	Late-successional coniferous forests	Indicator of snags as a habitat element and for other species which depend on woodpeckers for cavities or as prey.
Black-backed woodpecker	Snag-dependent	High elevation fir and lodgepole pine	Indicator of snags as a habitat element and for other species which depend on woodpeckers for cavities or as prey.

Migratory Birds

Migratory birds are identified in the memorandum of understanding that directs agencies under the Migratory Bird Act to focus on species of management concern along with their priority habitats and key risk factors. For the Forest, the migratory bird species of management concern are identified as species designated by the Regional Forester as sensitive species and the species listed under Standard and Guidelines 8-21 through 8-34 of the Forest Plan as management indicator species for project level assessment. Although federally-listed threatened or endangered species would be species of management concern, no migratory birds on the Forest are currently federally-listed as threatened or endangered so none are identified as species of management concern for this project.

3.5.5 Environmental Consequences

Alternative 1

Direct and Indirect Effects:

Species that are Federally-listed or Proposed, Sensitive, Survey and Manage, or Migratory Birds

Alternative 1 will result in no changes and, therefore, no direct effects to individual wildlife species or wildlife habitats (for threatened, endangered, and sensitive species, survey and

manage species, management indicator species, and migratory birds). The indirect effects expected would be those effects related to the continued increase of density-related mortality and disease. Habitat conditions would remain as described in the existing condition for an undetermined amount of time trending towards less healthy stand conditions. Overall, effects to wildlife and wildlife habitats of no action will result in 1) reduced availability and distribution of stands that could develop into suitable habitat for late successional habitat related species (northern spotted owl, wolverine, fisher, and goshawk); and 2) increased fuel loadings and increased risk of stand-replacing fire resulting in the potential loss of forested habitats in the project area. This will result in a decreased quality of forest habitat conditions (dense small diameter understory with few openings for stand diversity). Habitat for the threatened gray wolf will not be affected.

The Migratory Bird Act is followed through adherence to the memorandum of understanding that directs agencies to evaluate the effects of proposed actions on migratory birds. Specific effects of the project on species listed as sensitive or management indicator species are addressed in detail in the Terrestrial Wildlife Resource Report and the Management Indicator Species Report, Parts I and II; these are available on [the Project website](#). Since Alternative 1 does not propose action, there would be no direct effects of this alternative on migratory birds. Indirect effects would be the same as described in the previous paragraph.

Cumulative Effects:

Adding the effects of this alternative to the effects of reasonably foreseeable future actions will not lead to significant cumulative effects because adding the minor short-term or non-discernible effects of the future actions to the indirect effects of this alternative would not result in significant cumulative effects.

Alternative 2

Direct and Indirect Effects:

Federally-listed and proposed species

Northern Spotted Owl

The proposed treatment for all stands emphasizes reduction of present stocking levels to enhance development of the residual mid-mature and younger stems and increase the longevity of the mature stems. Treatment areas would retain snags and coarse woody debris in stream-course riparian leave areas. Large snags would be retained as long as snags do not pose a safety hazard; if felled, snags would be left in the treatment unit as woody debris. Other large snags would be retained with live trees in areas called “skip areas.”

Effects of this alternative are addressed as effects on foraging habitat; since there is no known nesting or roosting habitat in the analysis area, none is affected. Implementing proposed treatment activities in Alternative 2 would degrade 347 acres of foraging habitat; about 1.5 acres of foraging habitat will be removed through construction of one new landing (this landing is not within an owl activity center or in critical habitat). No acres will be downgraded to dispersal habitat in the analysis area. Definitions of degrade, downgrade, and remove are provided in the “analysis indicators” section (3.5.2) above. There would be long-

term beneficial effects to late-successional habitat on these acres as described in the effects analysis in the Silviculture Report for this project.

In critical habitat, 203 acres of foraging habitat would be degraded but none would be downgraded or removed; no nesting or roosting habitat would be affected since none is known to exist in critical habitat in the analysis area. The proposed treatments occurring within critical habitat will maintain primary constituent elements throughout the analysis area for the northern spotted owl to sustain essential life history functions.

The following table displays the acres affected in owl activity centers.

Table 3-31: Foraging Habitat in Home Range and Core Acres of Northern Spotted Owl Activity Centers Affected by Alternative 2

Activity Center Number	Core 0.5 mile radius around center			Home Range Plus Core Entire 1.3 mi Radius (includes the acres in the core)		
	Degrade	Downgrade	Remove	Degrade	Downgrade	Remove
KL0268	0	0	0	35	0	0
KL0382	0	0	0	62	0	0
KL4104	0	0	0	0	0	0

Gray Wolf

As discussed in the affected environment section, no known wolf dens occur in the analysis area. If a wolf was present in the project area, it would likely avoid noise that is created by human activity. Therefore, Alternative 2 is likely to have “no effect” on gray wolf. If, during the implementation of this project, wolf activity is detected in the project area, then project design features specific to wolves will apply (Chapter 2, section 2.2) and the presence of wolves on the landscape may require coordination and potentially new consultation under Section 7 of the Endangered Species Act with the USDI Fish and Wildlife Service.

North American Wolverine

Although there are no known den sites in the analysis area, it is possible that wolverine may be present. However, due to habitat fragmentation and limited availability of older forest conditions, wolverines are not expected to be abundant. Effects on wolverine and its habitat are discussed further under the Forest Service sensitive section.

Forest Service Sensitive Species, Survey and Manage, Management Indicator Species, and Migratory Birds

Due to the proposed actions within Alternative 2 either not occurring in known species ranges or not affecting any habitat, there are no expected direct or indirect effects on the following species: bald eagle, great gray owl, Siskiyou Mountain salamander, foothill yellow-legged frog, Cascade frog, and Tehama chaparral snail.

With the implementation of snag-related project design features and the limited activities proposed in older forested habitats in the watershed, Alternative 2 would not limit the

availability of large snag distribution for the pallid bat, fringed myotis, Townsend's big-eared bat, or the snag associated management indicator species in the analysis area.

With the implementation of riparian reserve related project design features and the limited activities proposed in the riparian habitat in the watershed, Alternative 2 would not limit the availability of riparian habitat conditions for the willow flycatcher, or the riparian associated management indicator species in the analysis area.

Pacific Marten: Alternative 2 would degrade about 278 acres of potential marten habitat but will retain habitat quality after treatment because the functioning of foraging habitat will continue as at present even though there will be some reduction in quality of habitat. There may be some loss of habitat structure after treatment; however, marten are expected to remain viable in treated areas and well distributed in the analysis area. The proposed treatments are not expected to have any effect on this species since these actions are either not occurring in suitable habitat or will not measurably alter habitat conditions.

Northern Goshawk, Fisher, and North American Wolverine: Suitable northern spotted owl foraging habitat is used as a proxy to evaluate the potential effects to northern goshawk, fisher, and wolverine habitat. The proposed thinning with product removal (thinning larger trees that can be sold as sawlogs) in Alternative 2 would occur on about 87 acres of foraging habitat. Thinning without product removal (thinning of small trees) in Alternative 2 would occur on about 78 acres of foraging habitat. The total affected acres of foraging habitat would retain suitable character for northern goshawk, fisher, and wolverine after treatment. The fuels reduction treatments associated would degrade but not downgrade 17 acres of foraging habitat. The total affected acres of habitat would retain suitable character for northern goshawk, fisher, and wolverine after treatment. Proposed underburning would occur on about 163 acres of foraging habitat. The proposed actions within dispersal and non-habitat are not expected to have any effect on northern goshawk, fisher, or wolverine since these actions are not going to occur in suitable northern goshawk, fisher, or wolverine habitat. About 1.5 acres of foraging habitat would be reduced to non-habitat (removed) by construction of one new landing. Removal of such a small number of acres of habitat will not measurably affect the species.

Migratory Birds

Specific effects of the project on species listed as sensitive or management indicator species are addressed above as sensitive or management indicator species. They are also addressed in detail in the Terrestrial Wildlife Resource Report and the Management Indicator Species Report, Parts I and II; these are available on [the Project website](#).

Cumulative Effects

Adding the effects of this alternative to the effects of reasonably foreseeable future actions will not lead to significant cumulative effects.

Alternative 3

Direct and Indirect:

Federally-listed and proposed species

Northern Spotted Owl

Effects to northern spotted owl in the project area are similar to those of Alternative 2 except that about 426 acres of foraging habitat would be degraded (compared to 347 acres degraded in Alternative 2), about 1.5 acres of foraging habitat will be removed through construction of one new landing (this landing is not in an owl activity center or in critical habitat). No acres of foraging habitat will be downgraded to dispersal habitat in the analysis area. The number of acres affected by this alternative increases over those of Alternative 2 (as displayed in Chapter 2, section 2-5) and more foraging habitat is affected, primarily because fuel reduction treatment acres are increased in Alternative 3 to provide more clearance around private land.

As in Alternative 2, in critical habitat 203 acres of foraging habitat would be degraded but none would be downgraded or removed; no nesting or roosting habitat would be affected since none is known to exist in critical habitat in the analysis area. The proposed treatments occurring within critical habitat would maintain primary constituent elements throughout the analysis area for the northern spotted owl to sustain essential life history functions.

The following table indicates the differences for owl activity centers.

Table 3-32: Foraging Habitat in Home Range and Core Acres of Northern Spotted Owl Activity Centers Affected by Alternative 3

Activity Center Number	Core 0.5 mile radius around center			Home Range Plus Core Entire 1.3 mi Radius (includes the acres in the core)		
	Degrade	Downgrade	Remove	Degrade	Downgrade	Remove
KL0268	0	0	0	35	0	0
KL0382	0	0	0	59	0	0
KL4104	0	0	0	0	0	0

Gray Wolf

Effects are the same as for Alternative 2.

North American wolverine

Effects are the same as for Alternative 2 except about 426 acres of wolverine foraging habitat would be degraded (compared to 347 acres of foraging habitat that would be degraded in Alternative 2). As in Alternative 2, no acres of foraging habitat will be downgraded. About 1.5 acres of foraging habitat would be reduced to non-habitat (removed) by construction of one new landing. Removal of such a small number of acres of habitat will not measurably affect the species.

Forest Service Sensitive Species, Survey and Manage, Management Indicator

Species and Migratory Birds

Effects of Alternative 3 would be the same as for Alternative 2 with the following exceptions:

Pacific Marten: Alternative 3 would degrade about 319 acres of potential marten foraging habitat (compared to 278 acres of foraging habitat downgraded in Alternative 2) but habitat quality would be retained.

Northern Goshawk, Fisher, and Wolverine: Proposed thinning with product removal would occur on about 104 acres of foraging habitat in Alternative 3. Thinning without product removal would occur on about 112 acres of foraging habitat. Fuel reduction treatments would degrade about 45 acres of foraging habitat and proposed underburning would occur on about 165 acres of foraging habitat. As in Alternative 2, no acres of foraging habitat will be downgraded to dispersal habitat. About 1.5 acres of foraging habitat would be reduced to non-habitat (removed) by construction of one new landing. Removal of such a small number of acres of habitat will not measurably affect the species

Cumulative Effects

Adding the effects of this alternative to the effects of reasonably foreseeable future actions would not lead to significant cumulative effects.

3.5.6 Comparison of Alternatives

Determination of Effects

The following conclusions led to the Forest's determination of effects that the proposed Craggy Project would have on federally-listed species:

Gray Wolf: Based on the above assessment of direct, indirect, and cumulative effects displayed in the Wildlife Resource Report, it is the Forest's determination that implementation of the Project will result in **"no effect to the gray wolf."**

Northern spotted owl: Based on the above assessment of direct, indirect, and cumulative effects, the Forest's preliminary determination for implementation of the Craggy Project is **"May Affect, Not Likely to Adversely Affect (MANLAA) NSO and NSO Critical Habitat."** This determination is based on the following factors:

- No treatment will occur in nesting or roosting habitat as none of this habitat is identified in the analysis area.
- No acres of foraging habitat will be downgraded to dispersal habitat in Alternative 2 or Alternative 3. About 347 acres of foraging habitat in Alternative 2 and 426 acres of foraging habitat in Alternative 3 will be degraded but will retain foraging quality after treatment.
- Application of project design features will minimize effects to northern spotted owl habitat and the likelihood that owls will be harassed, killed, or injured during project implementation.

- There will be an estimated 1.5 acres of foraging habitat removed with the proposed construction of one new landing with both action alternatives; this landing will not remove foraging habitat in an owl activity center or in critical habitat.

For the proposed species, the following is the determination:

North American Wolverine: Based on the assessment of direct, indirect, and cumulative effects, it is the Forest's conclusion that implementation of the Craggy Project will **“Not result in jeopardy to the North American wolverine.”**

Table 3-33: Comparison of Effects of Alternatives on Federally Listed, Forest Service Sensitive, Management Indicator, and Survey and Manage Wildlife Species

Species	Alternative 1	Alternative 2	Alternative 3
Northern spotted owl	No Effect	May Affect, Not Likely to Adversely Affect 347 acres of foraging habitat will be degraded, none will be downgraded, and 1.5 will be removed by construction of one new landing.	May Affect, Not Likely to Adversely Affect 426 acres of foraging habitat will be degraded, none will be downgraded, and 1.5 will be removed by construction of one new landing.
Northern spotted owl critical habitat	No Effect	May Affect, Not Likely to Adversely Affect 203 acres of foraging habitat will be degraded, none will be downgraded or removed.	May Affect, Not Likely to Adversely Affect 203 acres of foraging habitat will be degraded, none will be downgraded or removed.
Gray wolf	No Effect	No Effect	No Effect
Northern goshawk, fisher, and North American wolverine	No Effect	May affect individuals but is not likely to lead to a trend towards Federal listing. Project activity is proposed to occur within about 347 acres (12%) of habitat; however, these habitats will continue to be viable after treatment. 1.5 acres of habitat will be reduced to non-habitat by new landing construction.	May affect individuals but is not likely to lead to a trend towards Federal listing. Project activity is proposed to occur within about 426 acres (15%) of habitat; however, these habitats will continue to be viable after treatment. 1.5 acres of habitat will be reduced to non-habitat by new landing construction.
Pacific marten	No Effect	Degradation of about 278 acres of marten; habitat will continue to be viable after treatment.	Degradation of about 319 acres of marten; habitat will continue to be viable after treatment.
Bald eagle and Great gray owl	No Effect	No habitat affected	No habitat affected
Willow flycatcher	No Effect	With the implementation of riparian reserve related project design features and limited activities within habitat in the watershed this alternative will not limit the availability of habitat for this species.	With the implementation of riparian reserve related project design features and limited activities within habitat in the watershed this alternative will not limit the availability of habitat for this species.
Pallid bat, Townsend big-eared bat, and fringed myotis	No Effect	Alternative 2 will not limit the availability of large snag distribution. Forest-wide standards and guidelines for snags will be met or exceeded.	Alternative 3 will not limit the availability of large snag distribution. Forest-wide standards and guidelines for snags will be met or exceeded.

Species	Alternative 1	Alternative 2	Alternative 3
Yellow-legged frog and Cascade frog	No Effect	With the implementation of riparian reserve related project design features and the limited activities proposed in riparian habitat in the watershed, Alternative 2 will not limit the availability of habitat for these species.	With the implementation of riparian reserve related project design features and the limited activities proposed in riparian habitat in the watershed, Alternative 3 will not limit the availability of habitat for these species.
Siskiyou Mountain and Scott Bar Mountain salamanders	No Effect	No habitat affected. No known sites.	No habitat affected. No known sites.
Blue-gray tailedropper, Tehama chaparral snail, and western bumble bee	No Effect	No habitat affected. No known sites.	No habitat affected. No known sites.
Klamath Shoulderband	No effect	With the implementation of project design features, survey for the species, and management of known sites, there will be no effect on this species.	With the implementation of project design features, survey for the species, and management of known sites, there will be no effect on this species.
River/stream management indicator species	No Effect	With the implementation of riparian reserve related project design features and the limited activities proposed within riparian habitat in the watershed, Alternative 2 will not limit the availability of riparian habitat conditions.	With the implementation of riparian reserve related project design features and the limited activities proposed within riparian habitat in the watershed, Alternative 3 will not limit the availability of riparian habitat conditions.
Snag-dependent management indicator species	No Effect	Alternative 2 will not limit the availability of large snag distribution. Forest-wide standards and guidelines for snags will be met or exceeded.	Alternative 3 will not limit the availability of large snag distribution. Forest-wide standards and guidelines for snags will be met or exceeded.

3.5.7 Compliance with Law, Regulation, Policy and the Forest Plan

All action alternatives will comply with the Forest Plan and Survey and Manage Guidelines aimed at minimizing short-term impacts to individuals and providing for long-term wildlife population persistence as noted in the Wildlife Resource Report, Terrestrial Wildlife Biological Evaluation, Management Indicator Species Report, Parts I and II, and the Forest Plan Consistency Checklist. The design of this project is consistent with Recovery Actions described in the 2011 Northern Spotted Owl Recovery Plan, the 2012 northern spotted owl critical habitat designation, and the Migratory Bird Treaty Act as well as Forest Service sensitive species direction.

3.6 Aquatic Species

3.6.1 Methodology

The analysis of the potential effects to aquatic species and their habitat is based on analysis indicators that originate from the “Analytical Process for Developing Biological Assessments for Federal Actions Affecting Fish within the Northwest Forest Plan Area” (USDI, USDA, and NOAA 2004). Effects of project elements to an indicator may be positive (beneficial) or negative, and be (1) neutral (no effect), (2) discountable (extremely unlikely to occur) or

insignificant (effects are not able to be meaningfully measured, detected, or evaluated), or (3) significant (effects able to be measured). After the appropriate indicators have been evaluated, the resulting information is used to determine overall effects on aquatic species.

3.6.2 Analysis Indicators and Measures

The eight indicators that are potentially affected by the Craggy Project and will undergo further discussion are listed below along with measurements for each indicator. Information on reasons for the elimination of other potential indicators is presented in the Aquatic Species Resource Report, available on [the Project website](#).

Temperature of fish-bearing reaches of stream channels can affect aquatic species; lower temperatures are more beneficial to fish. This indicator is measured by the amount of shade adjacent to streams because increased shade keeps temperatures low.

Sediment and Substrate- the percentage of substrate composition that is of fine material can affect aquatic species because a high percentage of fine material disrupts survival of young fish. Both the composition of surface and subsurface of non-pool units, and volume of pools filled with fine material, affect fish. In the absence of survey data, cumulative watershed effects (CWE) models and professional judgment are used to measure this indicator. The universal soil loss equation (USLE) and mass wasting (GEO) models are used; see Bell 2012 for information on these models.

Turbidity – This indicator is rated by professional judgment following observation of conditions after high water events, amount of substrate fines, cumulative watershed effects models (USLE and GEO), and condition of riparian reserves. In addition, the distance to fish habitat and the likelihood of activities to introduce fine sediment into fish-bearing streams will also be incorporated into the effects analysis.

Large Woody Debris – This indicator is rated using amount of “large wood” per linear length of stream; it is only applicable in 3rd or larger order stream systems. The Forest Plan (which incorporates the Northwest Forest Plan) provides a definition of large wood (see the glossary in chapter 4 of this EIS) and guidelines as to an acceptable amount of such wood. If it is determined, through the use of professional judgment, that guidelines are inadequate or do not capture the nature of the system under consideration, channel width and potential of the site to produce and retain woody debris may be used. Potential for future large woody debris recruitment in both the short and long term should also be considered. Recruitment will be determined using the likelihood of the removal of standing trees that have a high probability of becoming large woody debris in the stream channel based on professional judgment and scientific literature.

Disturbance History and Regime – This indicator is primarily rated using CWE (equivalent roaded area (ERA), USLE and GEO) models. If professional judgment concludes that these models are not fully capturing disturbance risk, road density and location, current impacts from past stand-replacing timber harvest and wildfire, fire regime, vegetation regime, and development on private property may also be considered.

Peak and Base Flows – For the watershed-level, this indicator is rated using elements of ERA, road density, vegetation and riparian reserve condition, and other associated components. Any potential effects to flows due to a site-specific project element are considered individually.

Drainage Network – This indicator is rated by increase or decrease in drainage network as related to roads, ditches, and other similar structures.

Riparian Reserves – This indicator is a consideration of the riparian environs, and extends into the near uplands. It is rated as a synthesis of shade, large woody debris recruitment, and disturbance to the riparian reserve management area.

3.6.3 Spatial and Temporal Bounding of Analysis Area

The analysis area for aquatic resources includes effects at the site-specific and watershed-scale extent. Watersheds used in the analysis are at the 5th and 7th field level.

Site-specific analysis discussion will focus on water drafting within the range of anadromous and resident fish. For the remainder of the project area, project components are outside the distribution of analysis species, habitat is not present, or distance to occupied or suitable habitat is too distant for an effect to occur.

The temporal analysis timeframe includes effects during implementation, short-term effects expected to occur within the first year following implementation, and long-term effects (greater than one year).

3.6.4 Affected Environment

The only threatened or endangered fish in the analysis area is the Southern Oregon/Northern California Coasts Coho salmon (*Oncorhynchus kisutch*), including critical habitat. Sensitive fish species for the Klamath National Forest in the Project are the Upper Klamath-Trinity Rivers Chinook (*Oncorhynchus tshawytscha*), Klamath Mountains Province Steelhead (*Oncorhynchus mykiss irideus*), Klamath River lamprey (*Entosphenus similis*), and Pacific lamprey (*Entosphenus tridentatus*). Both steelhead and resident rainbow trout (*Oncorhynchus mykiss*) are management indicator species in the Forest Plan. Additionally, designated essential fish habitat is associated with Coho salmon and Chinook salmon.

Table 3-34 displays a summary of actual and potential occupancy by analysis species of creeks and rivers within 5th and 7th field watersheds.

Table 3-34: Actual and Potential Occupancy of Aquatic Species by 7th and 5th Field Watershed

Species	7 th Field Watershed					5 th Field Watershed
	Humbug Creek	Middle Fork Humbug Creek	South Fork Humbug Creek	Punch Creek	Sucker Creek	Klamath River
Coho	X,T	T	T			X
Chinook						X
Steelhead	X,T	X, T	X, T	X	T	X
Resident Rainbow Trout	X	X	X	X	X	X
Pacific Lamprey	X	P	P			X
Klamath River Lamprey	P	P	P			X

Species	7 th Field Watershed					5 th Field Watershed
	Humbug Creek	Middle Fork Humbug Creek	South Fork Humbug Creek	Punch Creek	Sucker Creek	Klamath River
X - confirmed present P - potential presence T - thermal refugia						

For the analysis indicators, baseline existing condition – “Properly Functioning,” “Functioning-at-Risk,” and “Not Properly Functioning” – applies principally to creeks which directly or indirectly support anadromous species.

Table 3-35 displays the baseline for analysis indicators for anadromous streams in the project area.

Table 3-35: Baseline for Project Area Aquatic Resources Indicators

Stream/River	Temperature	Substrate	Turbidity	Large Woody Debris	Dist. History/Regime	Peak/Base Flows	Drainage Network	Riparian Reserves
Humbug Creek	NF*	P	P	NF	FAR	P	FAR	FAR
Middle Fork Humbug Creek	P	P	P	NF	FAR	P	P	FAR
South Fork Humbug Creek	P	P	P	NF	P	P	FAR	FAR
Middle Klamath River	NF	NF	FAR	NF	FAR	NF	FAR	FAR
P - "Properly Functioning" FAR - "Functioning-at-Risk" NF - "Not Properly Functioning" *The lower 4.5 miles of Humbug Creek are "Not Properly Functioning"								

3.6.5 Environmental Consequences

Alternative 1

Direct and Indirect Effects

Under Alternative 1, the Project would not occur and no management actions would be taken. Legacy sediment sites identified for the Craggy Project would not be addressed. The effect to fish and fish habitat of not addressing the Craggy Project legacy sediment sites is insignificant to not measurable. While there are several sites present throughout the project area, most are distant from fish-occupied waters, and the current or potential sediment impact to their respective watershed is minimal. As all major streams in the project area, with the exception of the Klamath River, are considered to have good baseline water quality, even

with the continued existence of the legacy sites, if one or more sites were to experience catastrophic failure the impact downstream is likely to be minimal and short-term.

Cumulative Effects

Cumulative impact occurs when the effect of one project overlaps with or compounds the effects of another. The Craggy Project does not influence the implementation of any nearby project, nor visa-versa. The primary consequence to fish and aquatic habitat of not doing the project is related to legacy site impacts. However, the legacy site risk is part of the existing baseline; because the other projects are physically separate from the Project, their activities will neither influence nor exacerbate the existing condition. Therefore, without direct effects or a compounding indirect effect, there cannot be cumulative effects for Alternative 1.

Alternative 2

Direct Effects

Potential direct impacts to aquatic resources may occur as a result of water drafting and a temporary stream crossing. No other project elements include instream activities within fish-bearing waters. Fish screens, resource protection measures, best management practices, and fish mobility would preclude impingement. Fish temporarily avoiding water drafting activities are not likely to experience reduced feeding success, nor result in a significantly higher probability of exposure to predators.

Indirect Effects

Potential indirect impacts to aquatic resources would occur as a result of harvest and silviculture activities, prescribed fire, legacy site treatment, and water drafting. The indirect effects to indicators which may be affected by project activities are as follows:

Temperature – The Project would have a minor, short-term effect to stream flow during water drafting operations. However, the effects are not likely to have any detectable change to stream temperature in fish-bearing reaches or have any meaningful impact to fish habitat, including thermal refugia. There would be no meaningful effect to stream temperature from commercial harvest or silviculture activities because effective stream shade would be maintained. Similarly, prescribed fire would not impact stream temperature because over-story riparian vegetation would be maintained.

Sediment/Substrate – Most sediment which is mobilized by Project activities is expected to remain localized near to the site of disturbance due to the location of the project upon the landscape, functionality of riparian reserve buffers, project design features, and best management practices considered adequate to control overland movement of sediment. Because there would be no measurable transport of sediment to fish-occupied areas above the background level, indicators which directly or indirectly rely upon this metric (turbidity, pool frequency and quality) would not be affected. Neither fish nor their habitat would be affected by changes to the sediment regime caused by Project activities.

Turbidity – Only work associated with a temporary stream crossing and water drafting would occur within a stream channel, potentially creating turbidity.

There is one proposed temporary stream crossing located within a stream channel containing anadromous fish; this crossing would be treated to reduce possible sediment input using rocks, small culverts, and landscape fabric. The amount of ground disturbance and associated

stream turbidity likely as a result of this crossing upgrade is limited in scope and intensity. The Forest Service has consulted with National Marine Fisheries Service both programmatically (USDA 2004a) and on a project-specific basis on this type of work since Coho salmon was listed under the Endangered Species Act in 1997. As part of project planning and implementation, resource specialists design, and monitor the use of, project-specific best management practices to ensure that short-term impacts to fish habitat resulting from crossing upgrade work, especially related to sediment, are sufficiently minimized.

There are two legacy sites located within 300 feet of anadromous fish-bearing streams and five sites located within 300 feet of resident fish-bearing streams. Treatment of these sites, using project-specific best management practices, is likely to have only short-term, minimal impacts to fish and fish habitat. Other legacy sediment sites are well above habitat occupied by fish, and potential sediment generated from these activities is likely to be undetectable greater than 300 feet downstream of the site and, therefore, would not have any effect to fish or their habitat (USDA 2004a).

Where drafting sites are within fish-occupied waters, a small plume of suspended sediment is expected during operations, but turbidity would be localized, minimal in extent and duration, with the most likely fish behavior to be one of avoidance. No measurable increase in turbidity is expected beyond the immediate area where drafting occurs.

Large Woody Debris – Effects to recruitment and transport of large woody debris of an appropriate size to affect habitat attributes of fish-bearing streams is not expected. Creeks with fish and fish habitat adjacent to harvest units would retain similar rates of current large woody debris recruitment due to buffer width. Where a decreased input of smaller debris may affect function of fishless headwater systems, the impact would be short-term, localized, and unlikely to be noticeable downgradient within fish-occupied reaches. In the long term, benefits are expected throughout the project area via the growth of larger trees which may contribute to future large woody debris input.

Disturbance History/Regime – While there are some small CWE model increases as a result of this Project (see section 3.7 of this document for ERA results and all CWE model results on [the Project website](#)), there would be no significant effects to aquatic habitat from any Project activities. Model estimates for ERA and USLE remain below the threshold of concern, and this analysis concludes that the functional level of this indicator would not change. Model estimates for GEO, although over threshold for two 7th field watersheds, are not increased as a result of the Project. Additionally, indicators which directly or indirectly use this metric – peak or base flows, substrate, and turbidity - would not be measurably affected.

Peak/Base Flows – There would be no watershed-scale changes to peak or base flows as a result of Project activities due to treatment unit location on the landscape, minimal and localized impacts, and functioning buffering capacity of intervening riparian reserve habitat. This is reflected in ERA model output, which remains below the threshold of concern.

Drainage Network – In the short term, there would be an insignificant increase in the drainage network from landing and skid trail construction, with these impacts neutral in the long term due to subsequent rehabilitation and natural stabilization. Long term, there would be an insignificant decrease in the drainage network following hydrologic stabilization of temporary roads and legacy sediment site repair.

Riparian Reserves – Project activities would have both a short-term and a long-term effect to riparian reserves. In the short term, individual components which comprise the riparian reserve indicator would impart insignificant, mostly localized, effects which would not alter the functional level of the riparian reserve in the project area. In the long-term, harvest and silviculture treatments are expected to provide a landscape-scale benefit to riparian reserves in the form of larger trees and increased size of in-stream wood. However, this positive may be offset by prescribed fuels treatments which are insufficiently aggressive to fundamentally modify the existing riparian condition of an altered fire regime. Therefore, it is the professional judgment of the fish biologist that the long-term effect to riparian reserves is neutral.

Cumulative Effects

There would be minimal cumulative impacts to aquatics from current and reasonably foreseeable future projects within the vicinity of the Craggy Project. Cumulative impact occurs when the effects of one project overlaps with or compound the effects of another. In the project area, although projects may overlap project boundaries (Westside Fire Recovery, and Fuels Reduction Projects on Bureau of Land Management lands), or share a common watershed without physical boundary overlap (Yreka Flood Hazard Reduction Project and Lower Yreka Creek Full Restoration Project), there would be no significant adverse additive effects to aquatic habitat indicators. Cumulative watershed effects models either remain below the threshold of concern, or else are not exacerbated, when the effects of Alternative 2 and all current and reasonably foreseeable future projects are included in the model.

Alternative 3

Direct Effects

Direct effects are the same as described in Alternative 2; the same temporary stream crossing of an anadromous fish-bearing stream would be improved and used as in Alternative 2 and the same water drafting sites are available for use.

Indirect Effects

Potential indirect impacts to aquatic resources would occur as a result of harvest and silviculture activities, prescribed fire, legacy sediment site treatment, temporary stream crossing and water drafting. Even though there are different numbers of various treatments in the action alternatives, the indirect effects to aquatic species indicators which may be affected by project activities are the same as in Alternative 2.

Cumulative Effects

Cumulative effects are the same as in Alternative 2.

3.6.6 Comparison of Alternatives

Alternative 1 is not expected to have any effects on aquatic resources. Table 3-36 displays determinations concerning the effects of action alternatives on aquatic resources.

Table 3-36: Summary of Determinations on Aquatic Resources for Alternatives 2 and 3

Species	Special Status	¹ Determination
<i>Fish Species</i>		

Species	Special Status	¹ Determination
Coho Salmon (and critical habitat)	Federally Threatened	NLAA
Chinook Salmon (Spring/Fall runs) (Upper Klamath-Trinity Rivers)	FSS	NE
Steelhead Trout (Klamath Mountains Province)	FSS, MIS	MANL
Rainbow Trout (resident)	MIS	MANL
Pacific Lamprey	FSS	MANL
Klamath River Lamprey	FSS	MANL
<i>Other Habitat</i>		
Essential Fish Habitat (Coho/Chinook)		Will Not Affect
<p>¹<u>Federally Listed Species</u> NE - Will not affect the species or its Critical Habitat NLAA - May affect, not likely to adversely affect the species or its Critical Habitat LAA - May affect, likely to adversely affect the species or its Critical Habitat</p> <p><u>Forest Sensitive Species (FSS) / Management Indicator Species (MIS)</u> NE - No effect to the species (FSS and MIS) MANL - May affect individuals, but is not likely to lead to a trend towards listing (FSS); and/or May affect individuals, but is not likely to lead to a decreasing population trend (MIS) MALT - May affect individuals, and is likely to result in a trend towards listing (FSS); and/or May affect individuals, and is likely to lead to a decreasing population trend (MIS)</p>		

Table 3-37 displays the effects of all alternatives on analysis indicators.

Table 3-37: Effects of Alternatives on Analysis Indicators for Aquatic Resources

Indicator	Alternative 1	Alternative 2	Alternative 3
Temperature	0	-/0	-/0
Substrate/Sediment	0	-/+	-/+
Turbidity	0	-/0	-/0
Large Woody Debris	0	-/0	-/0
Disturbance History/Regime	0	-/0	-/0
Peak/Base Flow	0	-/0	-/0
Drainage Network	0/-	-/+	-/+
Riparian Reserves	0	-/+	-/+
<p>0 = Neutral effects - = Insignificant or discountable negative effects + = Insignificant or discountable positive effects S= Significant negative effects S+ = Significant positive effects */* = Short-term/long-term effects</p>			

3.6.7 Compliance with law, regulation, policy, and the Forest Plan

All alternatives will meet Forest Plan standards and guidelines, and comply with the Endangered Species Act, the Magnuson-Stevens Fishery Conservation and Management Act, and all other relevant regulations, laws, and policies. Section 7 consultation will be completed with the National Marine Fisheries Service for the preferred alternative when it is identified.

3.7 Hydrology

This section analyzes the effects of the Craggy Project on water quality in the project area and eight relevant 7th field watersheds.

3.7.1 Methodology

Water quality is dependent on many interconnected processes that are influenced by both upslope and in-stream conditions. The analysis of existing conditions and potential effects of the alternatives considered the following: field reviews and inventories, monitoring data, scientific literature, specialist reports, geographic information system (GIS) data analysis and modeling, and best professional judgment. Riparian reserve area widths on perennial streams were checked in the field on April 26, 2016 for a number of proposed units.

The risk assessment for peak stream flow uses one of the three cumulative watershed effects (CWE) models: the equivalent roaded area model (ERA). The models are a tool to estimate the direct, indirect and cumulative watershed effects of management activities. The equivalent roaded area concept was initially based on formulations by Harr et al. (1975) that drew correlations between reduction in canopy and water yield increases on experimental forested watersheds.

The model "... provides a simplified accounting system for tracking disturbances that affect watershed processes, in particular, estimates in changes in peak runoff flows influenced by ground-disturbing activities" (Bell 2012). This model provides a baseline by using the current level of disturbance, which includes past events and actions in the project area. The level of disturbance from various proposed Project activities (e.g., road construction, landings, thinning, etc.) within a given watershed is compared to the baseline to estimate effects of the proposed activities. This is expressed as *percent equivalent roaded area* (percent ERA); the theoretical maximum disturbance level acceptable is expressed as *percent threshold of concern* (percent TOC).

"The threshold of concern (TOC) is a measure of watershed sensitivity" (Bell 2012). It is a designated percent beyond which there may be measureable or observable evidence of impacts to channels and floodplains. These impacts may include the increase of fine grain sediment delivery to streams and the increase of some peak flows due to canopy reduction. The percent threshold of concern is calculated based on soil erodibility, hydrologic response, slope stability, channel sensitivity, and beneficial uses of each watershed. The thresholds for percent equivalent roaded area are listed by watershed in Table 3-38. For example, a watershed with high sensitivity would have a low threshold of concern for percent equivalent roaded area.

Percent equivalent roaded area is used to calculate a *risk ratio* for the ERA model. The model is named a "cumulative watershed effects" model because it adds up the effects of all the

activities being proposed for a project and provides a risk ratio for a set of activities in the proposed project or alternatives. A risk ratio greater than or equal to 1.0 (the threshold of concern for risk ratios for all watersheds) is a yellow flag and calls for a closer look at mitigation opportunities. Cumulative Watershed Effects: the Abridged Version (Bell 2012) provides a more detailed description of the model, its uses and limitations. The model can also estimate the cumulative risk ratio of adding the effects of past, present and reasonably foreseeable future actions to the effects of a set of proposed activities or alternatives. It is only this last modeled risk ratio that is the “cumulative effect” of the project according to the NEPA definition of cumulative effects.

The equivalent roaded area model was also run under a wildfire scenario for Alternatives 1 and 3. Potential wildfire watershed effects for Alternative 1 represent the effects of not implementing the Project; Alternative 3 results represent the effects of implementing treatments. Since there are only very small differences between Alternatives 2 and 3 in risk ratios, the model results for Alternative 3 under the wildfire scenario will be used as a proxy for the effects of Alternative 2. The modeling was generated using the FlamMap modeling for fire potential for zero to five years after Project implementation (see the Fire and Fuels Report for detailed methods). The resulting flame lengths were used with the equivalent roaded area modeling as proxy for fire severity in the project area units.

3.7.2 Analysis Indicators and Measures

Water quality indicators used in this analysis are stream temperature as determined by stream shade, sediment, and peak flow. Quantifiable estimation of effects to indicators will be based on field data collection and compared with regulatory benchmarks, as well as ERA model results where effects are difficult to observe and measure.

Changes in stream shade due to each set of activities is measured using a solar pathfinder (an instrument that can measure percent shade and can be used to estimate effects to shade from Project alternatives at the site scale). This indicator uses change to potential effective shade of the proposed action on perennial and late-flowing intermittent streams as a proxy for stream temperature.

Effects to the sediment indicator in the watersheds will be estimated using the ERA model results and road condition. Road condition has been assessed through field inventory of human-caused active or potential sediment sources to streams (legacy sediment sites) between February 2017 and May 2017.

The effects to peak flow in the watersheds are estimated using the ERA model and methods described in Grant et al. (2008) to translate the percent of a watershed with disturbance to changes in the hillslope water runoff that leads to changes in in-stream peak flows. Generally, peak flow increases are not measurable if less than 20 percent of basal area in a watershed is removed (Troendle et al. 2010).

3.7.3 Spatial and Temporal Bounding of Analysis Area

The watershed spatial scale is bound by eight 7th field watersheds that intersect the project area: Clear Creek, Greenhorn Creek, Upper Humbug Creek, Lower Humbug Creek, Middle Fork Humbug Creek, Rocky Gulch-Yreka Creek, Yreka City-Yreka Creek, and Long Gulch. As noted earlier in this environmental impact statement, there are several other 7th field

watersheds that are within the Craggy Project area but they total less than one percent of the project area and, therefore, are not included in this analysis.

The site scale is bound by the area proposed for treatment and the extent to which a treatment could affect channel reaches immediately downstream. Appendix B of this document displays maps of the analysis area 7th field watersheds and the legacy sediment site locations and the treatment plan for them.

The temporal scale for effects to stream shade in regard to percent of canopy reduction, is considered short-term for effects lasting less than 10 years or long-term where they persist for 10 years or more. Ten years is the time frame by which most effects of vegetation management are naturally recovered through re-growth (Grant et al. 2008).

Non-road-related equivalent roaded area modeled disturbances recover gradually over forty years. Since roads are “forever” and do not recover like vegetative disturbance, road-related sedimentation is constant year after year (Bell 2012). Equivalent roaded area results that are provided are for the effects immediately post-treatment for action alternatives. The combined effects to water quality of various management activities were assessed in combination with past and foreseeable future activities through the watershed effects process modeling.

3.7.4 Affected Environment

The Project is within the Yreka Creek-Shasta River and Humbug Creek-Klamath River 5th field watersheds. The Shasta River, a major tributary of the Klamath River, was listed as impaired for organic enrichment/dissolved oxygen in 1992, and as impaired for temperature in 1994, pursuant to Section 303(d) of the Clean Water Act (State Water Resource Control Board 2012). Dissolved oxygen concentrations are regularly too low to comply with the Basin Plan dissolved oxygen objectives. Water temperature conditions regularly exceed temperature thresholds that are protective of salmonids. Low dissolved oxygen concentrations and elevated water temperatures in the Shasta River and its tributaries have resulted in degraded water quality conditions that do not meet applicable water quality objectives, and impair designated beneficial uses. The designated beneficial uses that are not fully supported in the Shasta River include: cold freshwater habitat; rare, threatened, and endangered species; migration of aquatic organisms; spawning, reproduction, and early development of fish; commercial and sport fishing; and contact and non-contact water recreation.

The Klamath River is also listed as impaired for low dissolved oxygen, high water temperature, and high nutrient levels (State Water Resource Control Board 2012). The Klamath River has additional beneficial uses that are not designated for the Shasta River that may be adversely affected by inputs from the Shasta River. These beneficial uses include the Native American cultural use that supports cultural and traditional rights of indigenous people, such as ceremonial uses, and the subsistence fishing use.

North and east of Craggy Mountain the majority of riparian vegetation is on private land and has been altered by mine tailings. The lower third of Humbug Creek is dominated by willows with a scattered overstory of cottonwoods. The stream gradient is relatively shallow with a wide floodplain.

Alluvium deposits at the mouth of Humbug Creek are a combined result of 19th century mine tailings and the subsequent construction of dams on the Klamath River which reduce the

force of high flows. The creek commonly runs subsurface through the private land adjacent to the mouth of Humbug Creek in Section 16 of Township 45 North, Range 7 West, of Mount Diablo Meridian.

South and west of Craggy Mountain, including the headwaters of Humbug Creek and Cousins Gulch, the channel is constrained and a relatively narrow floodplain supports a riparian community of conifers, alders, and maples.

Stream Temperature and Shade

The North Coast Regional Water Quality Control Board (North Coast Water Board 2011) uses lack of stream shade as an indicator for stream temperature impairment. The regulatory standard requires that site-specific potential effective shade (shade on a watercourse equivalent to that provided by topography and potential vegetation conditions at a site) must be maintained unless it can be demonstrated that the proposed activities will result in a net long-term benefit to water quality and stream temperatures (North Coast Water Board, 2015). The justification for reducing stream shade must include the proposed canopy reduction, estimated recovery time, and an estimate of the pre- and post- project shade or solar impacts.

Stream shade was estimated generally for perennial streams on the Forest using a solar pathfinder (an instrument that can measure percentage of shade) with inputs for vegetation derived from remote sensing data in 2011. Air photo interpretation was used to verify the remote sensing data, and to identify reaches where stream shade has been reduced by human activities. The amount of shade loss due to human activities was estimated by comparing the modeled shade in altered reaches with nearby stream reaches that lack human disturbance (reference streams). Of the 84.4 percent of stream length of Humbug Creek assessed, the watershed average for existing shade was 88.5 percent (USDA 2011a), well above desired conditions (see stream temperature monitoring information in USDA 2012a). However, site-specific potential effective shade is still required to be determined within each project unit proposed within a riparian reserve to ensure no long term loss of shade occurs, as that would violate the 2015 Waiver.

Units within riparian reserves mentioned in Appendix A of the hydrology report have been assessed by the district hydrologist who determined that these riparian reserves could benefit from project activities: thinning or fuel reduction. Aquatic conservation strategy objectives would be maintained or restored in these riparian reserves (see Appendix F), shade buffers have been designed so as to have no negative effect to shade.

Not all activities proposed within riparian reserves have currently been assessed by a district hydrologist. In these cases, either standard Forest Plan riparian reserve widths will be applied (300 feet for fish bearing perennial streams, 150 feet for non-fish bearing perennial streams and intermittent streams), or if it is determined that treatment within outer portions of these riparian reserves would be beneficial to aquatic conservation strategy objectives and have no effect to shade, modified riparian reserve buffer and equipment exclusion zones will be fully divulged in the application for Waiver coverage under the 2015 Waiver. Such site-specific recommendations will only decrease treatment unit size over their existing extent. No increases will be proposed.

Stream Sedimentation and Channel Stability

Streams adjacent to proposed treatment areas are mostly small, first order intermittent streams (and a few perennial streams) at the middle to upper slope position. Modeled results that are lower than the threshold of concern by watershed indicate that upslope conditions are presently not contributing negative effects to water quality in the analysis area (Table 3-38).

Table 3-38: Equivalent Roaded Area Modeled Results for the Current Condition in 7th Field Watersheds

7 th Field Watersheds	7 th field Watershed Area (acres)	Percent ERAs	Percent TOC	Current ERA Risk Ratio*
Upper Humbug Creek	8,037	2.8	9.5	0.30
Middle Fork Humbug Creek	4,978	2.9	10.0	0.29
Clear Creek	2,781	3.6	10.5	0.35
Lower Humbug	7,830	1.6	10.5	0.15
Greenhorn Creek	7,734	6.1	9.0	0.68
Yreka City-Yreka Creek	7,054	2.8	12.0	0.23
Long Gulch	2,834	3.0	11.0	0.27
Rocky Gulch-Yreka Creek	2,102	1.5	11.5	0.13

*Threshold of concern for risk ratios is 1.0 for all 7th field watersheds.

Forest roads within highly erosive granitic soils have resulted in erosion problems throughout portions of the landscape and erosion can lead to sediment in streams. The legacy sediment sites, if not repaired and rehabilitated, have the potential to fail or divert as the result of a 100-year or smaller flood. Altogether the 293 legacy sites in the project area have an estimated volume of over 49,290 cubic yards, available to be discharged to project area streams (see Appendix B for maps of legacy sediment sites in the project area and their treatment plan). The most frequently observed, but usually low risk type of legacy site is rill and gully erosion from off-highway vehicle trails (mostly), system roads, and unauthorized routes resulting from improper, nonexistent, or malfunctioning drainage structures. Typically the higher risk sites are road crossings of large intermittent or perennial streams in undersized or failing culverts under large fill volumes. These sites often exhibit diversion potential (the potential for flow to divert down the road in the event that a large storm plugs the culvert), which can be the cause of large quantities of sediment discharge. All legacy sites are prioritized based upon a complex risk rating formula developed under the Road Sediment Source Inventory (USDA, 2012b). Treatment of legacy sites as required by the 2015 Waiver for total maximum daily load implementation will be detailed in the discussion of Alternatives 2 and 3 below.

Peak Stream Flow

Annual precipitation rates follow a steep gradient, decreasing west to east from about 50 inches per year to 20 inches per year. Snow frequently occurs in winter months above 4,000 feet. The north facing peaks such as McKinley Mountain and Mahogany Point retain the greatest amount of snowpack in early spring (USDA 1993).

No stream-gauging stations have been installed on streams in the analysis area to provide direct measurements of stream flow. Streams in the area that have recorded stream flows

respond quickly to rainfall events with prolonged low-flow recession limbs (rates of decrease in discharge as a stream's level falls after a rain). Historically, rain on snow events typically result in the largest peak flow, flood, and debris flow events (de la Fuente and Elder 1998).

Table 3-39 outlines existing versus desired condition in the project area for the analysis indicators. Stream temperature as maximum weekly temperature is not met in Humbug Creek, though shading throughout the project area exceeds desired levels by a large margin.

Table 3-39: Craggy Project Area Current Indicator Conditions vs. Desired Conditions

Indicator	Measure	Existing Condition	Desired Condition	Are desired conditions being met?
Stream Sedimentation	CWE model: ERA (% of watershed roaded)	1.5% to 6.1%	<0.4%	No
	Road Condition	293 Legacy Sites	0 Legacy Sites	No
Overall Average Shade	Percent shade average for watersheds	88.50%	≥ 69.7%	Yes*
Peak Flow	Equivalent roaded area	1.7% to 6.3%	< 6.5% to 9.0%	Yes

*Shade-a-lator model provides overall shade conditions. Site specific solar pathfinder measurements have been (and will be) taken within riparian reserves in treatment units. In some specific areas, shade is not meeting desired conditions.

3.7.5 Environmental Consequences

Alternative 1

Direct and Indirect Effects

In terms of temperature, it would be expected that conditions would remain the same or improve due to increasing streamside shade in the absence of a wildfire occurrence. Peak streamflow is expected to remain as at present in the absence of wildfire but increase substantially with wildfire.

Alternative 1 would not address any of the legacy sediment sites in the project area. Those sites would remain with the potential to deliver sediment into channels. The amount of potential sediment that would remain in the watershed and at risk of being delivered to stream-courses if no action is taken to address the legacy sites is 49,290 cubic yards.

This alternative would not reduce the severity of negative effects to water quality from a potential wildfire in the project area. The equivalent roaded area model was run for a wildfire scenario to help illustrate how a wildfire under this alternative could affect the watershed health including changes to sediment regimes, peak flow and changes to shade (see Table 3-40).

The effects of this alternative in the short term, *without* the occurrence of a wildfire, are the same as what was stated previously as current condition. The ERA risk ratios for Alternative 1 are below in Table 3-40. It may be expected that, in the event of a wildfire, stream shading and temperature would possibly be affected negatively; that is, a decrease in shading from burned riparian areas would lead to an increase in stream temperature.

Table 3-40: Alternative 1 - Equivalent Roaded Area Modeling Results

7 th field Watershed Name	Current ERA Risk Ratios	ERA Risk Ratios with future wildfire
Upper Humbug Creek	0.30	0.78
Middle Fork Humbug Creek	0.29	0.65
Clear Creek	0.35	0.76
Lower Humbug	0.15	0.94
Greenhorn Creek	0.68	1.04
Yreka City-Yreka Creek	0.23	0.24
Long Gulch	0.27	0.77
Rocky Gulch-Yreka Creek ⁷	0.13	0.85

Cumulative Effects

Past actions are accounted for in the affected environment description and Table 3-38 through Table 3-40. The ongoing or reasonably foreseeable future actions that have the potential for positive or negative effects to sediment, temperature, or peak flow are the Yreka Flood Hazard Reduction project, the Lower Yreka Creek Full Restoration Project and Side Channel Project, the City of Yreka Wildland Urban Interface Project, the Soap Creek Fuelbreak Maintenance, and the fuels reduction on Bureau of Land Management lands (see Appendix C of this document for the list of actions considered for cumulative effects).

The fuelbreak projects by the Bureau of Land Management lands (Long Gulch and Rocky Gulch-Yreka Creek 7th field watersheds), the City of Yreka Wildland Urban Interface (Rocky Gulch-Yreka Creek, Long Gulch, Yreka City-Yreka Creek, Greenhorn and Middle Humbug 7th field watersheds), and the Soap Creek Fuelbreak Maintenance (Greenhorn Creek 7th field watershed) may have minor short-term negative effects on analysis indicators while they are being implemented but the treatments performed by these fuel reduction projects will also have beneficial effects to the hydrology analysis indicators by reducing negative effects if a fire were to occur without the Craggy Project being implemented.

The Yreka Flood Hazard Reduction Project, Lower Yreka Creek Full Restoration Project and Side Channel Project will have long-term positive effects on peak flows in Yreka Creek. During the implementation of these projects there is likely a small increase in short-term sediment delivery to the stream systems. The change in sediment regimes is likely to last only through the first winter after implementation. These projects may reduce shade in the short term because of the activities proposed in the floodplain. They are also likely to improve conditions over all in the long term for Yreka and Greenhorn Creek.

The effects of the above projects are taken into account within the equivalent roaded area model runs (Table 3-40). Excluding the event of wildfire (the equivalent roaded condition

⁷ Data are not available for Rocky Gulch so it is assumed that this 7th field watershed is similar enough to Long Gulch that data for that watershed are used as a starting point. The effects of the recent Grade Fire in Rocky Gulch are added.

model does not actually predict probabilities of stochastic events that cannot be precisely predicted) the threshold of concern would not be exceeded in any Project watershed, currently or from the cumulative future effects of planned projects.

Adding the effects of Alternative 1 to the effects of other projects is not likely to produce significant cumulative effects.

Alternative 2

The following effects from Project activities would be reduced through implementation of project design features and best management practices (see chapter 2 and Appendix D respectively of this document). Project design features and best management practices are used to prevent or minimize negative effects to the extent that is possible and there are specific ones in place for protecting various indicators for water quality.

Direct and Indirect Effects

Direct effects include loss of ground cover, compaction and displacement of soil, and loss of canopy cover. Indirectly, loss of cover and displacement in the form of rutting can lead to surface runoff and erosion of soil surface layers. More information on the effects of this alternative on soil compaction and displacement are provided in the Soil Resource Report.

Periodic review of research on the effect of streamside buffers has found consistent results in terms of maintaining water quality (Castelle et al. 1994). Forest floors present a relatively high resistance to shallow surface flow. Contiguous buffers of any vegetative type, of about 100 feet will remove 80 to 90 percent of nutrient and sediment load, largely through resistance and dispersal of the transporting sheet wash.

Loss of canopy cover can increase evaporation because of shading reduction, but research has shown the greater effect is in fact a decrease in transpiration, leading to increased soil moisture (Jones 2000). While increased soil moisture increases soil weight, and under the right conditions it can lead to landslips, a more typical response is an increase in small peak flows, often in the autumn months, with recurrence intervals of well under one year (Grant et al. 2008). However, the amount of canopy reduction needed for measureable gain in peak flows in areas that have transient snow cover is a minimum of greater than 20 percent of the watershed.

There is also evidence that canopy reduction from uplands can lead to increased runoff during snow melt, both in total yield and peak flow (Troendle and King 1987, Burton 1997, Troendle et al. 2001). Open spaces frequently accumulate greater snow depth on the ground than a forest canopy by exposing less of it to solar radiation and wind (Geddes et al. 2005, Musselman et al. 2008). The canopy structure spreads snowfall over a greater surface area than it would occupy on the ground below. Also, the larger proportion of snow melt occurs while soil temperatures are cold enough to suppress plant activity and transpiration. Again these effects evidently occur only when at least 20 percent or more of the total watershed canopy is removed (Grant et al. 2008).

Over the past century paired catchment studies, many in the Pacific Northwest, have been conducted detailing impacts of canopy reduction on stream flow. These studies have been reviewed, with progressively more cases (Bosch and Hewlett 1982, Stednick 1996, Brown et al. 2005, Grant et al. 2008). These reviews have come to similar conclusions summarized as follows:

- Reducing cover has the greatest effect to increased runoff;
- However, canopy reduction of less than 20 percent does not typically have a measureable effect;
- Effects are greatest in runoff months; and
- Effects are greatest for small peaks with recurrence intervals of much less than 1 year.

The total canopy reduction in the Craggy Project watersheds, after project implementation, which may be approximated by the percent equivalent roaded area, would be between 1.9 and 4.75 percent if no wildfire should occur; this is well below the level typical to initiate changes in peak flow or yield.

The equivalent roaded area method of the cumulative watershed effects modeling process provides an accurate, if proxy, estimate of canopy reduction and thus of primary Project effects to hydrology. In both logging systems (ground-based and skyline) there would be a certain amount of disturbed ground adjacent to felled trees and their subsequent cabling along skid trails or cable corridors, though the effects will likely be of less intensity for cable corridors than for ground-based systems. It is also possible that amount of traveled ground in ground-based units would exceed the initial planning. Tepp (2002) showed in research from northeast Washington that supplemental skid trails are necessary when planned travel corridors were at 130 foot intervals, and the end result was little different than corridors set at 40 foot intervals, although detrimental disturbance is likely much less on supplemental corridors because of fewer passes.

The main objective for watershed project design features in regards to logging operations is to maintain integrity of the riparian reserves and connected network of small zero-order draws and swales that may be only ephemeral in nature. As displayed in the project design features in chapter 2, yarding of logs will completely avoid perennial channels and cross only intermittent channels at designated channels. Swales and small draws will not be used for yarding routes, nor approached closer than 20 feet except for purpose of crossing. Landings would not be constructed in riparian reserves, nor existing landings used that are less than 50 feet from a stream. Implementation of these project design features would minimize or eliminate negative effects to water quality.

The effects of the Project on shade (and therefore, stream temperature) would be very minimal. Shade has been measured on several streams within active treatment units (see the table in Appendix A of the Hydrology Report). Equipment exclusion and no cut boundaries have been set at distances that would eliminate any reduction in shade to streams. As mentioned above, several treatment units which are within or very near (with allowance for some mapping error) riparian reserves have not yet been assessed. In these cases either of the two scenarios on a site scale, will be implemented:

1. Forest Plan, riparian reserve widths of 300 feet for perennial fish bearing streams, or 150 feet for perennial (non-fish bearing) and intermittent streams.
2. In riparian reserves not meeting desired conditions for shade or vegetation composition, the outer portions may be treated by hand thinning or thinning from below. Equipment exclusion and no cut buffers would be set to prevent removal of

shade, and those locations (along with the precise buffer widths) would be divulged within the application for coverage under the 2015 Waiver.

The effects to in-stream sediment would be significant and positive from addressing the legacy sediment sites in the watersheds. Approximately 29,200 cubic yards of potential sediment would be treated through the implementation of a legacy site treatment plan in compliance with the 2015 Waiver. This plan would treat 78 of the 293 legacy sites (but over half of the total potential sediment from all legacy sites in the project area) by stormproofing and hydrologic stabilization.

Stormproofing would involve all or some of the following activities:

- Installation of critical dips over stream crossings to eliminate diversion potentials.
- Replacement of undersized culverts.
- Outsloping to restore natural drainage patterns.
- Installation of rolling dips to restore natural drainage patterns.
- Maintenance or removal of inboard ditches and cross drains.
- Spot rocking and surface hardening.
- Fill reduction over culverts.
- Any other action necessary to reduce the risk of water quality degradation from human-caused sediment sources.

Hydrologic stabilization of unauthorized routes and mining related structures:

- Removal of all fill from stream crossings.
- Redirection of diverted springs.
- Stabilization of sliver fill failures on over-steepened road fill.
- Significant outsloping of old road surfaces enough to restore nearly natural drainage patterns.
- Removal of old culverts.
- Any other actions necessary to reduce the risk of water quality degradation from road sediment and fills.

The legacy site treatment plan will not be finalized until after enrolled under the 2015 Waiver, which will take place soon after the Record of Decision is signed. Hydrologic stabilization indicated on the map of the legacy sediment site treatment plan in Appendix B and stormproofing on 46N22 and 45N39 are certain, however the other roads indicated on this map as “potential stormproofing” are less certain. This is because the 2015 Waiver requires the treatment of a certain number of legacy sites, those within the project activities. There are 78 legacy sites that intersect with project units, and therefore 78 legacy sites will be treated in compliance with the 2015 Waiver. However, the Waiver allows for trading of those legacy sites for those that are higher risk within the larger planning boundary of a project (or adjacent HUC12 watershed). Though not finalized, this is the Forest’s plan for compliance with the Waiver requirements for legacy site treatment. Roughly 50 legacy sites

will be treated via hydrologic stabilization. The rest of the required legacy sites (roughly 28) will be treated via stormproofing two or more sections of the roads indicated as such on this map.

Please see the discussion under Alternative 3 for the results for the equivalent roaded area model that was run using a modeled wildfire scenario.

Table 3-41: Equivalent Roaded Area (ERA) Results for Alternative 2 (in acres)

7 th field Watershed Name	ERAs added by Alternative 2	Total ERAs for Alternative 2
Upper Humbug Creek	292	519
Middle Fork Humbug Creek	55	200
Clear Creek	88	189
Lower Humbug	71	196
Greenhorn Creek	34	508
Yreka City-Yreka Creek	16	210
Long Gulch	20	104
Rocky Gulch-Yreka Creek	8	39

Cumulative Effects

Only in the Lower Humbug 7th field watershed are ongoing and reasonably foreseeable future actions expected to result in any cumulative effects for the Craggy Project. Therefore, risk ratios are the same as for direct and indirect effects for all other 7th field watersheds as displayed on Table 3-42.

The effects are the same for Alternative 2 as for Alternative 1 from ongoing and reasonably foreseeable future actions. These projects will not measurably increase the magnitude of effects to water quality when added to actions in Alternative 2 from the Craggy Project.

Table 3-42: Cumulative Risk Ratios for Alternative 2

7 th field Watershed Name	ERA risk ratios for Alternative 2 from direct and indirect effects and past actions and events	ERA risk ratios for Alternative 2 when the effects of ongoing and future actions are added
Upper Humbug Creek	0.68	0.68
Middle Fork Humbug Creek	0.40	0.40
Clear Creek	0.65	0.65
Lower Humbug	0.24	0.26
Greenhorn Creek	0.73	0.73
Yreka City-Yreka Creek	0.25	0.25
Long Gulch	0.34	0.34
Rocky Gulch-Yreka Creek	0.16	0.16

Alternative 3

Direct and Indirect Effects

This alternative was developed in response to concerns related to hazardous fuels reduction adjacent to private lands and sediment displacement resulting from log-haul and road construction. For a description of the differences between alternatives see chapter 2.

The direct and indirect effects from Project activities would be the same generally, as for Alternative 2. Legacy site treatment would not change between alternatives because the same requirements from the 2015 Waiver apply to both alternatives because the alternatives have a very similar overall footprint. Table 3-43 below displays the model results for equivalent roaded area for alternative 3.

Table 3-43: Equivalent Roaded Area Model Results for Alternative 3

7 th field Watershed Name	ERAs added by Alternative 3	Total ERAs for Alternative 3
Upper Humbug Creek	248	475
Middle Fork Humbug Creek	36	181
Clear Creek	76	178
Lower Humbug	57	182
Greenhorn Creek	34	508
Yreka City-Yreka Creek	10	204
Long Gulch	18	102
Rocky Gulch-Yreka Creek	8	39

Cumulative Effects

As for Alternative 2, only in the Lower Humbug 7th field watershed are ongoing and reasonably foreseeable future actions expected to result in any cumulative effects for Alternative 3 of the Craggy Project. Therefore, risk ratios are the same as for direct and indirect effects for all other 7th field watersheds as displayed on Table 3-44.

Table 3-44: Cumulative Risk Ratios for Alternative 3

7 th field Watershed Name	ERA risk ratios for Alternative 3 from direct and indirect effects and past actions and events	ERA risk ratios for Alternative 3 including effects of ongoing and reasonably foreseeable actions
Upper Humbug Creek	0.62	0.62
Middle Fork Humbug Creek	0.36	0.36
Clear Creek	0.61	0.61
Lower Humbug	0.22	0.24
Greenhorn Creek	0.73	0.73
Yreka City-Yreka Creek	0.24	0.24
Long Gulch	0.33	0.34
Rocky Gulch-Yreka Creek	0.16	0.16

3.7.6 Comparison of Alternatives

Table 3-45 below displays a comparison of the equivalent roaded area model results between alternatives. The wildfire scenario for modelling was run with Alternative 3 vegetation thinning treatments considered as described in the methodology section. Risk ratios were

reduced in the watersheds by an average of 20 percent, indicating that risk of erosion or mass wasting from the effects of wildfire is less after treatment than in the event of a fire without treatment. The exercise was not repeated for Alternative 2 because of the relative similarity of the two alternatives. It is assumed that the results will be similar for Alternative 3 as for Alternative 2. See Table 3-46 below for the risk ratios results for each watershed.

Table 3-45: Comparison of Equivalent Roaded Area (ERA) Risk Ratios for Alternatives 1, 2 and 3

7 th field Watershed Name	ERA risk ratios for Alternative 1	ERA risk ratios for Alternative 2	ERA risk ratios for Alternative 3
Upper Humbug Creek	0.30	0.68	0.62
Middle Fork Humbug Creek	0.29	0.40	0.36
Clear Creek	0.35	0.65	0.61
Lower Humbug	0.15	0.24	0.22
Greenhorn Creek	0.68	0.73	0.73
Yreka City-Yreka Creek	0.23	0.25	0.24
Long Gulch	0.27	0.34	0.33
Rocky Gulch-Yreka Creek	0.13	0.16	0.16

Table 3-46: Equivalent Roaded Area (ERA) Model Results Due to Wildfire for Alternatives 1, 2 and 3 under the Wildfire Scenario

7 th field Watershed Name	ERA risk ratios under wildfire scenario for Alternative 1	ERA risk ratios under wildfire scenario for Alternative 2 or 3
Upper Humbug Creek	0.78	0.26
Middle Fork Humbug Creek	0.65	0.04
Clear Creek	0.76	0.25
Lower Humbug	0.94	0.06
Greenhorn Creek	1.04	0.03
Yreka City-Yreka Creek	0.24	0.01
Long Gulch	0.77	0.05
Rocky Gulch-Yreka Creek	0.85	0.03

The thresholds for tree canopy removal that would actually result in measureable changes to peak flow regime are far in excess of the Project proposals, as well as the cumulative total of those proposals with current conditions and foreseeable future management (see Appendix C for a description of foreseeable future impacts). The result of equivalent roaded area modeling is that no more than 4.75 percent total tree canopy would be removed in any watershed in the analysis area with implementation of action alternatives (Alternatives 2 or 3). Vegetation manipulation effects are short-term as re-growth occurs and in some cases exceeds pre-project levels. Canopy cover for Alternative 1 is expected to remain the same or increase due to natural growth without the event of a wildfire. It is expected to decrease in the event of a wildfire.

Riparian reserve buffers have minor effects on flow regime, they are effective in preventing some amount of erosion that would occur in their absence. Stream shading is an important factor in maintaining water temperatures, and will be maintained despite some activities in

riparian reserves. Project design features that minimize negative effects to analysis indicators, including those related to management of riparian reserves, are displayed in chapter 2.

Fine grain, largely suspended sediment from road runoff will continue, and is probably the largest component of negative direct effects on water quality (Bilby et al. 1989, Luce and Black 1999, Sugden and Woods 2007). The availability of material to move from roads is strongly and positively correlated to traffic and maintenance level and so is impossible to disentangle from the need for roads to access resources. Addressing legacy sediment sites will reduce sediment from roads, either by stabilizing potential fill and cut slope failures that constitute potential mass wasting or attending through maintenance to minor issues such as rills on the road surface from small seeps.

3.7.7 Compliance with law, regulation, policy and the Forest Plan

The conditions in the Waiver of Waste Discharge Requirements for Nonpoint Source Discharges Related to Certain Federal Land Management Activities on National Forest System Lands in the North Coast Region will be met for this project as described in the Hydrology Report. Details about compliance including legacy site treatment plan and no effect to shade determination and complete CWE modeling results will be included in the application for coverage under the 2015 Waiver. Meeting the Waiver requirements equals compliance with the Clean Water Act. Forest Plan standards are met by consistency with the Aquatic Conservation Strategy (Appendix F) and the Forest Plan Consistency Checklist, available on [the Project website](#). More information about compliance with law, regulation, and policy may be found in the Hydrology Report.

3.8 Soils

3.8.1 Methodology

The analysis of the effects of individual management activities on the soil resource (soil productivity and soil ecosystem functionality) is guided by the Forest Plan's standards and guidelines and Forest Service Manual 2500, Chapter 2550, Supplement 2500-2012-1. Both these sources indicate that soils in at least 85 percent of treatment areas must achieve desired conditions to meet standards for soil productivity (15 percent or less not meeting desired soil conditions is the acceptable threshold). Soil productivity is affected by the amount of coarse woody debris that is present as well as other organic material in the soil cover.

The proposed activities for the project were categorized into similar activity types. For example, all of the various silviculture treatments that use ground-based equipment were lumped into "Ground-based Tractor Logging with Associated Landings." Treatment areas proposed for skyline cable yarding were also assessed separately for tethered harvesting equipment for the purposes of comparing its effects with skyline cable yarding, assuming similar potential disturbance as ground-based tractor logging. The projected acres not meeting desired conditions for each indicator and activity type were determined from data collected from previous projects on the Forest using the National Forest Soil Disturbance Monitoring Protocol. More detailed information is available in the soil resource report, available on [the Project website](#).

Standards and thresholds for soil erosion are also provided in the Forest Plan and Forest Service Manual; these thresholds vary from 50 percent soil cover to 80 percent based on the type of activity and soil type in each unit. An erosion hazard rating, a relative measure of the soil's sensitivity to erosion processes and levels of soil cover, was calculated for each of the proposed treatment units to estimate the potential erosion hazard for a given soil type. Soil disturbance has the potential to increase the erosion hazard because soil cover is generally reduced. A maximum erosion hazard rating was calculated for soil that is completely bare to determine the risk of soil loss in areas without protection from soil cover. Then the erosion hazard rating for the current conditions of treatment areas was calculated using data collected on existing conditions of soil cover.

Using a unit selection strategy based on soil sensitivity and type of management activities planned, a sample of the treatment units were selected for survey of existing soil conditions.

3.8.2 Analysis Indicators and Measures

Three indicators of soil productivity and soil erosion were chosen that address relevant issues in the project and measure compliance with Forest Plan standards and guidelines. The indicators include soil stability, soil organic matter, and soil structure.

The unit measures for each indicator are acres not meeting desired conditions. Soil stability desired conditions are not met when major portions of the area lack soil cover, effective erosion control measures, or both. Soil organic matter desired conditions are not met when major portions of the area have had the upper soil layer displaced or removed to a depth and area large enough to affect productivity for the desired plant species. Soil structure desired conditions are not met when major portions of the area have reduced infiltration and permeability capacity indicated by soil structure and macro-porosity changes.

3.8.3 Spatial and Temporal Context

For all three soil indicators, the analysis area is bounded by the potential treatment units within the project area where soil-disturbing activities may take place. The analysis is further bounded in time by the foreseeable future period during which effects of this project could persist as detectable, significant effects. Soil cover, as it affects soil stability, can recover quickly as needles and other organic debris are deposited on the forest floor. The temporal boundary for soil stability is five years. Soil organic matter can take years to decades to rebuild after it is lost through displacement or erosion. Once compacted, structure can remain affected for decades. The temporal boundary for soil organic matter and soil structure is 30 years.

3.8.4 Affected Environment

Soils in the project area have developed from meta-sedimentary and granitic parent materials. Soil textures are generally gravelly to very gravelly loams on meta-sediment parent material, with the more developed soils having clay loam subsoils. The granitic parent material developed loamy sand to sandy loam soils. Geomorphic landforms are predominately steep mountain sideslopes and more gently sloping dormant landslide landforms. Soil depths range from moderately deep to very deep (from 24 to more than 60 inches deep).

Soil productivity is a measure of a soil's ability to produce vegetation. Generally, deeper and finer textured soils are more productive than shallower and coarser textured soils. Overall,

the soils in the treatment area are generally moderate to highly productive with small areas of low productivity. Current soil erosion hazard ratings for soils in treatment areas, based on existing conditions, are low.

The slope within proposed treatment units ranges from zero to 100 percent with an overall average of 47 percent. Average existing total soil cover ranges from 80 to 100 percent and averages 97 percent overall in the project area.

Calculated from 1,021 soil plots, approximately ten percent of the treatment units have soil disturbance from past activities excluding system roads (for information on how soil disturbance is classified, see Table 1 and the discussion under analysis indicators in the Soils report on [the Project website](#)). In plantations, 62 percent of the disturbance is on existing terraces that were built after the 1955 Haystack fire in the 1960s, 16 percent is on existing skid trails, one percent is on old temporary roads, seven percent is on off-highway vehicle trails, two percent is on established skyline corridors, and five percent is on old established landings. Desired conditions for soil stability were met across all of the treatment units as no signs of erosion were found. Desired conditions for soil organic matter and soil structure were met on an average of 97 percent of the treatment units.

3.8.5 Environmental Consequences

Alternative 1

Direct and Indirect Effects

There are no direct effects from Alternative 1, as soil-disturbing project activities would not take place. Soil cover, and therefore soil stability, for erosion protection would not change in the treatment areas. Soil organic matter would continue to accumulate faster than decomposition rates, with no additional benefit to soil fertility. Soil structure conditions would remain the same in the short term, with very slow long-term natural recovery of old skid trails and landings. Indirect effects of Alternative 1 would be the increased accumulation of organic matter. Increases in organic matter may lead to intense wildfire with high soil-burn severity effects, especially on soils with granitic parent material; see the Fire and Fuels Resource Report for additional information.

Cumulative Effects

Past actions including timber harvest, tractor piling, and terracing, are evident on the landscape in the treatment area and are reflected in the discussion of the affected environment. Since no reasonably foreseeable future actions that affect soils will occur in the proposed treatment areas, and past actions are part of the affected environment, there will be no cumulative effects on soil beyond the indirect effects above.

Alternative 2

Direct and Indirect Effects

The proposed activities that may impact soil stability, soil organic matter, and soil structure include ground-based tractor logging, temporary road construction on existing road beds, new temporary road construction, and mastication. Soil stability and soil organic matter are also affected by skyline yarding, prescribed fire, and pile burning. See chapter 2 of this document for more details on these activities. Implementation of project design features will reduce the potential for negative effects from these activities. Alternative 2 will maintain

adequate soil cover, protect soil organic matter, and maintain soil structure at levels sufficient to protect soil productivity and prevent soil erosion. The total treatment area not meeting desired conditions for soil stability, soil organic matter, and soil structure is 157 acres (1.5 percent), 276 acres (2.6 percent), and 105 acres (1.0 percent) respectively, totaling 5.1 percent which is below the threshold of concern. The potential use of tethered harvesting equipment in place of skyline yarding is expected to increase the percentages of the total treatment area not meeting desired conditions for soil stability, soil organic matter, and soil structure are 179 acres (1.7 percent), 341 acres (3.3 percent), and 159 acres (1.5 percent), respectively; for a total of 6.5 percent which remains below the threshold of concern. A full description of how the proposed activities may impact soil function can be found in the soil resource report.

Cumulative Effects

Past actions including timber harvest, machine piling, and thinning are evident on the landscape in the treatment areas and are reflected in the discussion of the affected environment. No reasonably foreseeable future actions are expected in treatment areas that would impact soil stability, soil organic matter, or soil structure. Adding the effects of Alternative 2 to the effects of past, present and reasonably foreseeable future actions will not have measurable effects on surface and soil organic matter, stability or structure, and, therefore, no cumulative effects will exceed the analysis indicator thresholds in the Forest Plan.

Alternative 3

Direct and Indirect Effects

The proposed activities that have a potential to impact soil stability, soil organic matter, and soil structure are similar to Alternative 2. Alternative 3 has fewer acres of mastication, the ground-based yarding portion of thinning with forest product removal, miles of new temporary road constructed and temporary road constructed on existing roadbeds than Alternative 2. However, Alternative 3 has more acres of fuelbreaks, underburning, and thinning without forest product removal than Alternative 2. A full description of how the proposed activities may impact soils can be found in the soil resource report.

For Alternative 3 the percent of the total treatment area not meeting desired conditions for soil stability, soil organic matter, and soil structure is 129 acres (1.1 percent), 228 acres (2.0 percent), and 90 acres (0.8 percent) respectively, for a total of 3.9 percent which is below the threshold of concern. The potential use of tethered harvesting equipment in place of skyline yarding is expected to increase the percentages of the total treatment area not meeting desired conditions for soil stability, soil organic matter, and soil structure are 149 acres (1.3 percent), 288 acres (2.5 percent), and 140 acres (1.2 percent), respectively, for a total of 5 percent which is below the threshold of concern.

Cumulative Effects

The cumulative effects of Alternative 3 will be similar to those of Alternative 2. No cumulative effects will exceed the analysis indicator thresholds.

3.8.6 Comparison of Alternatives

Action alternatives would maintain adequate soil cover, protect soil organic matter, and maintain soil structure at levels sufficient to protect soil productivity and minimize soil erosion. The acres that do not meet desired conditions will be minor compared to the total treatment acres in the Project. These acres will account for minor portions of any one stand so stand productivity will not be negatively affected. The following table compares each alternative for each analysis indicator by the measure of total acres and the percent of the project area affected.

Table 3-47: Summary of Estimated Acres (and percentages of treatment areas) Not Meeting Desired Conditions for Soil Indicators as a Result of Project Activities

Analysis Indicators	Alternative 1	Alternative 2	Alternative 3
Total Acres and Percent of the Treatment Area Not Meeting Desired Conditions With Skyline			
Soil Stability	0 acres (0%)	157 acres (1.5%)	129 acres (1.1%)
Soil Organic Matter	314 acres (3%)	276 acres (2.6%)	228 acres (2.0%)
Soil Structure	314 acres (3%)	105 acres (1.0%)	90 acres (0.8%)
Total Acres and Percent of the Treatment Area Not Meeting Desired Conditions With Tethered Equipment			
Soil Stability	0 acres (0%)	179 (1.7%)	149 (1.3%)
Soil Organic Matter	314 acres (3%)	341 (3.3%)	288 (2.5%)
Soil Structure	314 acres (3%)	159 (1.5%)	140 (1.2%)

3.8.7 Compliance with law, policy, regulation and the Forest Plan

Forest Plan standards and guidelines for soils will be met for all alternatives as displayed in the Forest Plan consistency checklist, available on the Project website. The number of acres that do not meet desired conditions for soil stability, soil organic matter, and soil structure is minor in relation to the total treatment area, and is minimized by implementation of project design features.

3.9 Geology

The Forest Service Manual Chapter 2880 (Geologic Resources, Hazards and Services) requires the assessment of the risk of loss of life, property and natural resources from both naturally-occurring and management related landslides. The risk must be minimized or mitigated when possible. The Forest Plan directs the interdisciplinary team to manage vegetation on unstable lands to maintain or enhance slope stability (Forest Plan Standard and Guideline 2-1). Project-level review of the unstable lands is required to validate the current mapping (Forest Plan Standard and Guideline 2-2). Unstable lands are defined as active landslides, inner gorges, toe zones of dormant landslides and severely-weathered and dissected granitic lands. These features are considered riparian reserves (Forest Plan Standard and Guideline, Management Area 10-2).

3.9.1 Methodology

Landslide volume is estimated by the cumulative watershed effects (CWE) Geology (GEO) model (CWE report-available on [the Project website](#)) and represents the magnitude of a

landslide event. Although this model is labeled as a “cumulative watershed effects” model, it does not measure cumulative effects as defined by the Council of Environmental Quality for NEPA analysis (CEQ 2005). Instead, it provides information on the effects of alternatives by adding the effects of various activities proposed for each alternative (i.e. road construction, landings, thinning, etc.) to result in a risk ratio for the process model. It also provides information on the added effects of past activities and events to provide a baseline risk ratio to which to compare the effects of proposed alternatives. For the GEO model the threshold of concern for the risk ratio is 1.0. A risk ratio greater than or equal to 1.0 is a yellow flag and calls for a closer look at mitigation opportunities. Cumulative Watershed Effects: the Abridged Version (Bell 2012) provides a more detailed description of the model.

Landslide volume is obtained using the empirical mathematical GEO model to estimate the volume of sediment delivered to the mouth of a 7th field watershed due to all types of landsliding during a 10-year storm event. The coefficients in the mathematical equation were developed in the Salmon River basin and the model assumes the geomorphic landforms react identically regardless of elevation. The indirect effects will be analyzed using the landslide volume estimates attributed to the alternative relative to the existing condition volume estimates in terms of landslide risk and a landslide risk ratio.

3.9.2 Analysis Indicators and Measures

Landslide risk is the chance of effects of injury or loss as a measure of the probability and adverse consequences to safety, property, or natural resources (see the Geology Resource Report available on [the Project website](#) for additional information). Landslide risk is a combination of landslide likelihood, determined by geomorphic landform, disturbance, landslide modeling and road density, and the potential consequences to human safety, infrastructure, property, recreation or visitor use, and environmental resources. The analysis uses existing geomorphic mapping, bedrock mapping and historical landslide information, and project-level field review to validate current mapping, in order to determine the likelihood of landsliding.

A *very high* risk means that there is an immediate and urgent need to reduce the likelihood of landsliding or mitigate the consequence to the elements at risk. A *high* risk means that project-wide and global mitigations need to be in place to minimize impacts to landslide processes for actions in these watersheds. A *moderate* risk means strategic or localized mitigations need to be in place to minimize impacts to landslide processes for actions in these watersheds. A *low* or *very low* risk means that remediation of landsliding consequences, if needed at all, may be the most cost effective method of dealing with these areas. Project effects are also comparable in terms of their risk ratios, with a higher risk ratio being more negative than a lower risk ratio.

3.9.3 Spatial and Temporal Context

The spatial scale for analysis is the 7th field watershed scale for the direct, indirect, and cumulative effects. The models used for analysis are calibrated at a 7th field scale. The temporal scale is zero to 10 years for short-term and greater than 10 years for long-term effects. Elevated landslide rates due to forest management have been shown to begin to decrease around seven to 12 years after disturbance in Northern California (Ziemer 1981).

3.9.4 Affected Environment

Upper Humbug Creek, Middle Fork Humbug and Lower Humbug Creek have a *high* landslide risk. They have a *highly likely*, *highly likely* and *likely* landslide likelihood, respectively. A landslide event would have potential effects to endangered fish habitat and the potential for damage to private property with a low probability of a landslide affecting an occupied residence and the primary ingress and egress route for the community of Humbug, California. Clear Creek has a *moderate* landslide risk because of a *likely* potential for landsliding and the potential for damage to private property with a low probability of a landslide affecting an occupied residence. Greenhorn Creek has a *very low* landslide risk primarily because landslides are *unlikely* in the watershed. Yreka City-Yreka Creek and Long Gulch will have a *low* landslide risk because it is *unlikely* that they will experience a landslide event during a 10-year storm event and consequences would be *minor*. Rocky Gulch-Yreka Creek has a *moderate* landslide risk as a result of disturbance from the Grade Fire in August 2016.

3.9.5 Environmental Consequences

Alternative 1

Direct and Indirect Effects

No treatment in the project area would lead to decreased tree vigor and in some stands increased tree mortality due to competition in the timber stands over time. Without treatment the species diversity of the timber stands would decrease, making the stand more likely to be impacted by highly intense and severe wildfire (see Fire and Fuels Report and Silviculture Report). If no wildfire should occur within the spatial and temporal boundaries of this analysis the landslide likelihood would decrease slightly over time as the areas affected by past disturbances recover. However, the risk will remain high for Upper, Middle, and Lower Humbug because of the high road densities in the watersheds.

If a wildfire should occur in the project area and no treatment is implemented, the GEO risk ratios would be increased to over the threshold of concern of 1.0 for Upper, Middle, and Lower Humbug, Clear Creek, Greenhorn Creek, Long Gulch and Rocky Gulch-Yreka Creek. This would lead to landslide risk for Middle Humbug Creek moving from a *high* landslide risk to a *very high* landslide risk. It would also lead to Clear Creek moving from a *moderate* landslide risk to a *high* landslide risk. Upper Humbug and Lower Humbug Creeks would continue to have a *high* landslide risk even with a wildfire event. Greenhorn Creek would remain *very low*. Long Gulch and Yreka City-Yreka Creek would remain at *low*. Rocky Gulch-Yreka Creek would have a *moderate* landslide risk if the rest of the watershed were to burn as the fuels model predicts. To see the change in risk ratio for the analysis area with no action with or without a wildfire event, see Table 3-48.

Cumulative Effects

The only action considered a reasonably foreseeable event that will have an effect on landslide risk is a timber harvest plan on private land in Lower Humbug Creek. The timber harvest plan covers a small area and will only increase the risk ratio in the watershed by 0.01. This is not enough to increase the landslide risk for the watershed. This means that the cumulative landslide risk remains the same for all watersheds in the analysis area as described in the direct and indirect effects section above.

Alternative 2

Direct and Indirect Effects

The direct and indirect effects of Alternative 2 will not measurably affect (change) the landslide risk or risk ratios of any of the watersheds; most of the effect displayed in Table 3-38 is a decrease in risk ratios. The silvicultural prescriptions are mainly thinning from below in plantations which will have little effect on the root support in the watershed. The logging systems are a combination of tractor logging and skyline or tethered systems and have been designed either with project design features or project design components (i.e. silvicultural prescriptions, location of new landings, fuels treatment placement, etc.) to minimize effects to landslide processes.

Chatwin (1994) found scheduling activities with the use of wet weather operation standards and normal operating seasons was effective at reducing negative effects to hillslope hydrology especially on the occurrence of rilling and gulying, the implementation of which will indirectly minimize effects to landslide risk. Cristan et al. (2016) concluded that roads, skid trails, and stream crossings have the highest impact on hillslope hydrology changes including rilling and gulying. Madej et al. (2012) found that the rate of sediment delivered to creeks from landslides was reduced by improved road and landing construction standards, reduced ground disturbance from tractors for ground-based harvest and from treating legacy sediment sources. Litschert and MacDonald (2009) found that using best management practices meant only 19 of 200 sites that had undergone timber harvest had rills or gullies in the Sierra Nevada Forest Service lands.

There are more than 20 project design features that are intended to reduce the probability of hillslope hydrology changes and changes to root support. The protection of riparian reserves including landslides, inner gorges, and swales in combination with partial harvest techniques that leave some understory vegetation intact have been found to substantially reduce the increase in landslide probability after timber harvest (Sidle 1992; Dhakal and Sidle 2003). Cristan et al. (2016) concluded that implementation of best management practices were most effective in reducing effects to watershed processes when implemented both during treatment activities and at the close of the project. The overall effectiveness of project design to maintain sufficient root strength for slope stability is extremely high. This alternative will not lead to a change in the landslide risk for any of the watersheds analyzed.

Should a wildfire occur in the project area after Alternative 2 treatments, any negative effects (negligible in some of the watersheds, not measurable in others) will be easily outweighed by the benefits to the landslide processes; treatments reduce the greater negative effects from a wildfire event that would occur without treatment. The risk ratios for the watersheds would be reduced by 30 to 68 percent from what they would be with no action (Alternative 1). Upper Humbug would see the greatest benefit to landslide processes with the risk ratio being 40 percent lower under Alternative 2 than for Alternative 1.

Should a wildfire event occur in the project area Alternative 2 is expected to overall have fewer effects on landslide processes than Alternative 1. As far as the analysis indicators are concerned Alternative 2 will reduce the landslide likelihood for Upper, Middle Fork, and Lower Humbug Creek and Clear Creek from *almost certain* to *highly likely*. Greenhorn Creek and Long Gulch would be reduced from *highly likely* to *likely*, and Yreka City-Yreka Creek is reduced to an *unlikely* landslide likelihood. Rocky Gulch-Yreka Creek landslide

likelihood results stay the same as described under Alternative 1. For Alternative 2, Middle Fork and Lower Humbug Creek will move to a *high* landslide risk instead of going to a *very high* risk as it would under Alternative 1 if a wildfire event takes place. Greenhorn Creek will move to a *very low* risk; the landslide risks for the other watersheds remain the same as in Alternative 1 with a wildfire.

However, even though the risk categories do not change for every watershed, the risk ratios with Alternative 2 treatments and then a wildfire event are much lower than is described for Alternative 1 with a wildfire (see Table 3-48).

Cumulative Effects

The only action considered a reasonably foreseeable event that will have an effect on landslide risk is the same timber harvest plan mentioned in Alternative 1 and it will have the same effects on Alternative 2. The 0.01 increase to the risk ratio for the Lower Humbug Creek watershed is not enough to increase the landslide risk category for the watershed. This means that the cumulative landslide risk remains the same for all watersheds in the analysis area as described in the direct and indirect effects section above.

Alternative 3

Direct and Indirect Effects

The effects on landslide risk of Alternative 3 are the same as for Alternative 2 even though the GEO risk ratio is 0.01 less for the Upper Humbug Creek watershed under Alternative 3 than under Alternative 2.

Cumulative Effects

The cumulative effects are the same as described in Alternative 2.

3.9.6 Comparison of Alternatives

Implementation of the action alternatives do not measurably change the landslide risk in a negative manner. The increase in risk ratios from the implementation of either Alternative 2 or 3, compared to Alternative 1, result in no more than a 0.01 increase. On average there is a substantially increased landslide risk if no action is taken (Alternative 1) and a wildfire event occurs, than if the action alternatives are implemented and then a wildfire event occurs after their implementation.

Table 3-48: Summary of GEO results for 7th Field Watersheds under Alternative 1 with a Modeled Wildfire Event and Action Alternatives with a Modeled Wildfire Event for Zero to Five Years after Project Implementation

7 th Field Watershed Name	Existing Risk Ratio	Alternative 2 or 3 Risk Ratios (Indirect Effects)	Alternative 1 Risk Ratio with Wildfire	Alternative 2 or 3 Risk Ratio with Wildfire	Reduction in Risk Ratio from Fire Effects Under Alternative 2 or 3
Upper Humbug Creek	1.37	1.28	4.23	1.97	53%
Middle Fork Humbug Creek	1.10	0.89	2.48	1.54	38%
Lower Humbug Creek	0.52	0.47	1.82	1.09	40%

7 th Field Watershed Name	Existing Risk Ratio	Alternative 2 or 3 Risk Ratios (Indirect Effects)	Alternative 1 Risk Ratio with Wildfire	Alternative 2 or 3 Risk Ratio with Wildfire	Reduction in Risk Ratio from Fire Effects Under Alternative 2 or 3
Clear Creek	0.61	0.62	1.86	1.10	41%
Greenhorn Creek	0.49	0.49	1.12	0.53	52%
Yreka City-Yreka Creek	0.29	0.29	0.77	0.25	68%
Long Gulch	0.59	0.59	2.16	1.38	36%
Rocky Gulch-Yreka Creek	0.75	0.75	2.94	2.06	30%

Table 3-49: Percent of Watershed that is Likely to Burn with High or Moderate Soil Burn Severity for All Alternatives

7 th Field Watershed Name	Alternative 1 Percent of Watershed Likely to Burn With High or Moderate Soil Burn Severity	Alternative 2 or 3 Percent of Watershed Likely to Burn With High or Moderate Soil Burn Severity
Upper Humbug Creek	25%	9%
Middle Fork Humbug Creek	25%	18%
Lower Humbug Creek	25%	20%
Clear Creek	25%	16%
Greenhorn Creek	10%	9%
Yreka City-Yreka Creek	1%	1%
Long Gulch	10%	9%
Rocky Gulch-Yreka Creek	10%	9%

Table 3-50: Summary of Effects to Landslide Risk with and without Wildfire Scenario

Indicator	Alternative 1	Alternative 2	Alternative 3
Landslide Risk with no wildfire scenario	There are three 7 th field watersheds with high landslide risk (Upper, Middle Fork, and Lower Humbug Creek), two with a moderate risk (Clear Creek and Rocky Gulch-Yreka Creek), two with a low risk (Yreka City-Yreka Creek and Long Gulch), and one with a very low risk (Greenhorn Creek).	Same as Alternative 1.	Same as Alternative 1.

Indicator	Alternative 1	Alternative 2	Alternative 3
Landslide Risk with wildfire scenario	There are two 7 th field watersheds with a very high landslide risk (Middle Fork and Lower Humbug Creek), three with high risk (Upper Humbug Creek, Clear Creek and Rocky Gulch-Yreka Creek), and three with low risk (Greenhorn Creek, Yreka City-Yreka Creek, and Long Gulch).	There are five 7 th field watersheds with high landslide risk (Upper, Middle Fork, and Lower Humbug Creek, Clear Creek and Rocky Gulch-Yreka Creek), two with a low risk (Yreka City-Yreka Creek and Long Gulch), and one with a very low risk (Greenhorn Creek).	Same as Alternative 2.

3.9.7 Compliance with Law, Policy, Regulation, and the Forest Plan

Existing mapping was field-verified by the Forest geologist and unstable lands were removed from treatment areas where slope stability was not benefited. The landsliding magnitude and risk were analyzed for all of the alternatives in the Project. The risk associated with the direct, indirect, and cumulative effects of the Project have been minimized by project design features and best management practices. The Project is consistent with Forest Plan standards and guidelines as described in the Forest Plan Consistency Checklist in the project record, which is available on [the Project website](#).

3.10 Air Quality

The purpose of this report is to analyze the effects of the project and its alternatives on air quality including the ambient air quality standards. The analysis will also include discussion on haze impacts on wilderness values associated with good air quality.

3.10.1 Methodology

Ambient Air Quality Standards

Siskiyou County is identified as in attainment for ozone, carbon monoxide, sulfur oxides, lead, respirable particulate matter, and fine particulate matter (criteria pollutants) for both state and federal standards. Under the Conformity Rule, there is no further state or federal regulation for project activities that generate criteria emissions and these criteria pollutants do not need to be analyzed further.

Regional Haze Rule

The Regional Haze Rule (1999) requires a Regional Haze Plan for Class 1 designated airsheds. These include National Parks and Wilderness established before 1977. Human-related sources of haze include industry, motor vehicles, agricultural and forestry burning, and dust from disturbed soils. The primary concern is the reduction of visibility in wilderness areas.

The Regional Haze Rule requires that states make reasonable progress towards achieving natural visibility conditions in Class 1 areas. Reasonable progress means that the worst haze days get less hazy *and* that visibility does not deteriorate on the best days when compared with the baseline period of 2000 to 2004 (California Air Resource Board, 2009). Federal agencies should not prevent this progress through management activities. The analysis will include an evaluation of the estimated residence time of smoke from Project activities and its impact to the worst days' haze to determine compliance with the Regional Haze Rule.

Greenhouse Gas Emissions

Prescribed burning activities for the Craggy Project include prescribed underburning and pile burning. Pile burning may occur in any of the treatment units except for mastication. Prescribed burning activities release greenhouse gases including carbon dioxide and methane into the air which can contribute to climate change. Currently there are no thresholds for greenhouse gas emissions for prescribed burning activities. Emissions of greenhouse gases are commonly expressed in a common metric which is the carbon dioxide equivalent. Some greenhouse gases are more potent than others and this metric allows for the direct comparison of impacts between different activities with different ratios of greenhouse gases emissions.

The average greenhouse gas emissions from prescribed fire are estimated using the First Order Fire Effects Model. The modeling is based on a Douglas-fir - tanoak - madrone forest under moderate weather conditions with a natural or activity fuel load. The defaults of the model in this mode are used for the model runs. The First Order Fire Effects Model is recognized by the Forest Service Pacific Southwest Region as being the most current and accurate analysis tool available for emissions prediction (Reinhardt et al. 1997). It is based on extensive research in western forest ecosystems.

3.10.2 Analysis Indicators and Measures

- Compliance with the Regional Haze Rule
 - Estimated days of visibility impacted in the Wilderness
 - Likelihood of preventing progress of the California Regional Haze Plan
- Estimated Greenhouse Gas Emission

3.10.3 Spatial and Temporal Context

It is difficult to determine the spatial analysis area for effects to air quality due to the mobility of air. For this project, the spatial boundary includes the project area and the Marble Mountain Wilderness Class I airshed under the Clean Air Act. Temporally, emissions from mobile sources such as logging trucks and tractors, as well as from prescribed burning, are transient and the impacts are short-lived and the air quality regulations are in terms of one-year emissions. In light of this, the temporal analyses are on an annual basis and this is considered short-term. Impacts are considered long-term if they persist for more than a year. The cumulative effects of these emissions will be addressed at the project scale including the Marble Mountain Wilderness which is about 16 miles away from the Project.

3.10.4 Affected Environment

According to the California Air Resources Board website (<http://www.arb.ca.gov/>), Siskiyou County is in attainment for all criteria air pollutants.

The project area is primarily forested federally-managed lands with no substantial human-caused emission sources within the area other than emission and fugitive dust from logging and recreation. Other emission contributions will be smoke and haze from seasonal wildland and prescribed fires from both within and outside the County. According to the California Air Resources Board, the nitrogen oxide emissions in the County are primarily from heavy-

duty diesel trucks (such as from the I-5 corridor). This report was run using the following website: <http://www.arb.ca.gov/app/emsinv/emssumcat.php> (California Air Resources Board 2012).

The Marble Mountain Wilderness is designated as a Class 1 wilderness by the Clean Air Act. The haze species concentrations are measured as part of the IMPROVE (Interagency Monitoring of Protected Visual Environments) monitoring network deployed throughout the United States. The 24 days with the worst visibility are averaged each year and used to determine the worst days' visibility. The visibility conditions for the Marble Mountain Wilderness are currently monitored by an IMPROVE monitor in the Trinity Alps. The worst air quality days are dominated by organic aerosols (they are particulate matter associated and cause a haze in the air). Organic aerosols peak during the summer months and are strongly correlated with the incidence of wildfires (California Air Resource Board, 2009). The amount of light extinction affects visibility or the clarity of objects viewed at a distance by the human eye. This is measured in "deciviews" which are the amount of obstruction the haze in the air causes; higher numbers mean you cannot see as far into the distance.

3.10.5 Environmental Consequences

Alternative 1

Direct and Indirect Effects

Under this alternative no management action will be taken that will emit greenhouse gases or impact the visibility in the Marble Mountain Wilderness.

Cumulative Effects

There are no direct or indirect effects for this alternative and therefore no cumulative effects.

Alternative 2

Direct and Indirect Effects

The prescribed fire proposed in the project area will occur over a few days of any given year. Burning will occur in the spring or fall, outside of the wildfire season. Since the wildfire season is the time of the year when haze is at its worst, the Project won't impact visibility on the worst haze days. The likelihood that prescribed burning on a few days any given year will affect the average visibility on the best days over an entire year is small. The likelihood of preventing the progress of the Regional Haze Plan is very low for this alternative.

The greenhouse gas analysis uses the same assumptions as the Ambient Air Quality Standards analysis. An estimated 0.26 metric tons per acre and 31 metric tons per acre of emissions of methane and carbon dioxide respectively from prescribed fire in activity fuels will be created. One metric ton of methane is equivalent to 21 metric tons of the carbon dioxide equivalent. Therefore, prescribed fire on one acre of activity fuels will emit about 5.5 metric tons per acre of carbon dioxide equivalent. This alternative proposes prescribed fire on about 9,700 acres of activity fuels. Therefore, the greenhouse gas emissions will be about 10,670 metric tons of carbon dioxide equivalent per year (assuming five years for implementation of activity fuels).

It is not currently feasible to quantify the indirect effects of individual or multiple projects on global climate change and, therefore, determining significant effects of those projects or

project alternatives on global climate change cannot be made at any scale (USDA 2009). Because greenhouse gases mix readily into the global pool, it is not currently possible to ascertain the indirect effects of emissions from single or multiple sources (projects). Also, because the large majority of Forest Service projects are extremely small in the global atmospheric carbon dioxide context, it is not presently possible to conduct quantitative analysis of actual climate change effects based on individual or multiple projects (USDA 2009).

Cumulative Effects

Adding the effects on air quality from Alternative 2 to effects of ongoing or reasonably foreseeable future actions in the project area is expected to have minimal cumulative effects at the spatial analysis scale. Criteria pollutant and greenhouse gas emissions will degrade air quality cumulatively with activities occurring in the surrounding area. However, these emissions are expected to be minimal and able to disperse readily. Compliance with Burn Day, Marginal Burn Day, and No Burn Day designations, and coordination with and permitting from the Siskiyou County Air Pollution Control District, will minimize cumulative effects of prescribed fire.

As greenhouse gas emissions are integrated across the global atmosphere, it is not possible to determine the cumulative impact on global climate from emissions associated with any number of particular projects. Nor is it expected that such disclosure would provide a practical or meaningful effects analysis for project decisions (USDA 2009).

Alternative 3

Direct and Indirect Effects

The effects of Alternative 3 are the same as for Alternative 2 except there are 10,550 acres of burning proposed instead of 9,700 as is proposed in Alternative 2. The likelihood of the progress of the Regional Haze Plan will remain the same as in Alternative 2. Greenhouse gas emissions will be increased to 11,605 metric tons of carbon dioxide equivalent per year.

Cumulative Effects

The cumulative effects are the same as in Alternative 2.

3.10.6 Comparison of Alternatives

Table 3-51: Comparison of the Effects of Alternatives on Air Resources and Greenhouse Gas Emissions.

Indicator	Alternative 1	Alternative 2	Alternative 3
Compliance with Regional Haze Rule	Complies	High likelihood of Compliance	High likelihood of Compliance
Greenhouse Gas Emissions (metric tons/year)	0	10,670	11,605

3.10.7 Compliance with law, policy, regulation, and the Forest Plan

The Project is not anticipated to result in an adverse impact to air quality because compliance with Siskiyou County Air Pollution Control District burn day designations and permits has resulted in continued attainment status designations for both federal and state standards. The

Project meets requirements for the General Conformity Rule and the Regional Haze Rule under the Clean Air Act.

3.11 Scenery

3.11.1 Methodology

This evaluation applies current National Forest Landscape Management methodology in conjunction with existing Forest Plan direction. It relies on geospatial information system analysis, field observations from sensitive viewpoints, modeling to determine visibility of Project activities, and a literature review of public preferences for scenic quality.

3.11.2 Analysis Indicators and Measures

Indicators

Visual Quality Objectives

Proposed landscape treatments are measured against the Forest Plan identified thresholds for acceptable visual change. Visual quality objectives, per Agricultural Handbook 462 are defined below:

- *Retention*: Management activities are *not visually evident*, and may only repeat form, line, color, and texture, which are frequently found in the landscape. Changes in their qualities of size, amount, intensity, direction, pattern, etc., should not be evident.
- *Partial Retention*: Management activities are noticeable, but remain *visually subordinate* to the characteristic landscape, and may repeat form, line, color, or texture common in the landscape.
- *Modification*: Vegetation and landform management activities *may visually dominate* the original characteristic landscape; however, they must *borrow from the naturally-established form, line, color, or texture at a level and scale that the visual appearance of the activity mimics those natural features occurring within the surrounding area*.
- *Maximum Modification*: Vegetation and landform management activities *may dominate* the characteristic landscape; however, *when viewed in the background zone (three to five miles), the visual appearance must mimic those natural features within the surrounding area or character type*. When viewed in *foreground or middle ground*, the activity may not appear to completely borrow from the naturally-established form, line, color, or texture.

Measures

Scenic resources are evaluated from Forest Plan-designated sensitive viewpoints, roads, trails, as well as recreation points with extended viewing times. **Distance Zones** are evaluated as follows:

Foreground: The detailed landscape found within 0-0.25 and 0.5 miles from the observer.

Middleground: The landscape located between 0.25 and 0.5 miles to three to five miles from the observer.

Background: The distant landscape located between three to five miles and infinity.

Table 3-52 displays sites identified as evaluation viewpoints for the Project, including the visual sensitivity level and distance zones.

Table 3-52: Evaluation Viewpoints and how they are considered

Viewpoint/Road/Trail	Visual Sensitivity Level	Distance Zone
County Road 7J002 (Hawkinsville)	Moderate	Foreground, Middleground
County Road 7H01 (Greenhorn)	High (first 1.3 miles – the high-sensitivity designation ends 0.4 miles west of the junction of Bennett Drive)	Foreground, Middleground
County Road 7H01 (Greenhorn)	Moderate (8.5 miles to analysis area boundary at the junction of Deadwood Creek Road)	Foreground, Middleground
Forest Road 45N28	Moderate	Foreground, Middleground, Background
Forest Road 45N39	Moderate	Foreground, Middleground
Humbug OHV Area (and associated trails)	Moderate	Foreground, Middleground
Yreka (Community)	High	Middleground, Background
Visual Sensitivity Level:		
High: High public use, corresponding with a high level of visual scenery interest.		
Moderate: Moderate public use, corresponding with a moderate level of visual scenery interest.		

3.11.3 Spatial and Temporal Bounding of Analysis Area

The spatial bounding includes the entire project area up to the boundary for direct, indirect, and cumulative effects, and also includes the following areas beyond the boundary:

- The community of Yreka, and,
- Those portions of County Road 7H01 (Greenhorn Road) affected by a proposed fuelbreak.

Short-term scenery contrast (effects) may range between three and 10 years. Generally, beyond 10 years, the effects of soils and vegetation contrasts, slash, and stumps decrease, depending on decomposition rates and vegetation response. Long-term effects are also variable, and may be longer than 10 years up to 45 years for all distance viewing zones. While some visual effects may be seen beyond 45 years, it is assumed here that all proposed treatments in the Project area without intervening treatments will appear natural to the public after that time. Note that as required by Forest Plan analysis, these are the treatments seen in all distance zones from Level 1 and 2 (high and moderate) visual sensitivity roads, the Humbug Off-Highway Vehicle Recreation Area and associated trails. Because Visual Quality Objectives cover every acre of the Forest, effects include all seen areas affected by proposed project alternatives within and outside of the project area, regardless of visual sensitivity levels. See the Scenery Report for a more detailed explanation about the temporal bounding.

3.11.4 Affected Environment

Current Topography, Hydrology, and Vegetation:

The Craggy Project consists of rugged topography with elevations ranging from just under 2,000 feet along the Klamath River to approximately 6,200 feet near McKinley Mountain. Topography is heavily influenced by the ridgeline that bounds the project area at all cardinal points, except for a break at the confluence of Humbug Creek and the Klamath River. Humbug Creek and associated tributaries also influence the topography of deeply-incised drainages. Major peaks along the ridgeline include China Peak and Vesa Bluffs to the north, Deadwood Baldy Peak, McKinley Mountain, Gunsight Peak, Mahogany Point, and Montana Peak to the west and south, and Badger Mountain to the east.

The eastern ridgeline boundary and east-facing slopes of the project area form the sense of place backdrop (for background on the multiple meanings of “sense of place” within a forest management context, refer to Stedman 2003) for those living within the community of Yreka and its immediate surroundings. Throughout the project area, and especially as seen from Yreka, slope vegetation patterns, natural and created openings, road lines, and other landscape details become more visible under appropriate atmospheric conditions, such as when highlighted by sunlight or by snow events. Conversely, they become less visible during precipitation, or when concealed by low cloud cover or fog.

Vegetation patterns are pronounced throughout the project area, and the appearance is either one of textures, such as interspersed mixed conifers and brush across the slopes in foreground and middleground views, or a dense and continuous conifer, and oak and brush canopy in middleground and background views. The landscape elements of the watershed can be best characterized as heterogeneous, fragmented, patchy, and finely-textured (USDA 1993).

Culture and Disturbance:

A network of Siskiyou County and Forest Service roads traverse the project area, facilitating access to the Humbug Off-highway Vehicle area. Evidence of road lines and scattered private residences, or other evidence of human habitation are seen in middleground views across the project area.

Most of the project area lies within the extent of the 1955 Haystack Fire, and much of the post-fire area was salvage logged and reforested (refer to the Silviculture Report for more details). Part of these timber operations resulted in the visual evidence of terrace forestry, as revealed in unnatural-appearing vegetation patterns as seen in middleground and background. In foreground views, the terraced slopes are prominent, as are the planted tree rows.

Before Forest Service stewardship, the Humbug landscape was heavily disturbed by mining activities beginning with hand placer mining in the early 1850s to 1860s. Hydraulic mining began in the 1870s and played out during the 1880s. Miners then moved upslope out of drainages to mine lode deposits, creating the scattered adits and tailings now seen throughout the watershed (Stumpf 1979).

Human-caused and natural fire was the main disturbance mechanism that dominated the appearance of vegetation in the Klamath Mountains (Whitaker 1960). Overall, the project area was affected by frequent fires of low to mixed severity (Skinner and Taylor 2006, Taylor and Skinner 1998). Original vegetation patterns were likely characterized by complex mosaics of age, size, and spatial structure (Wills 1991). Early 20th century accounts of pine and mixed conifer forests noted similar spatial structure patterns of wide tree spacing, denser

tree clumps or groupings, small dense patches of seedlings and saplings, non-forested openings, shrub fields and meadows (Larson and Churchill 2012).

Overall, past disturbance patterns of fire suppression, mining, logging, and replanting have altered the project area vegetation from the more irregular, open, and structurally diverse patterns ecologically established by the historic fire regimes. The current condition comparatively is a much more uniform and dense forest and shrub habitat, with smaller openings. This condition trends away from meeting forest ecological health objectives and the Forest Plan standard of perpetuating ecologically-established scenery.

3.11.5 Environmental Consequences

Alternative 1

Direct and Indirect Effects

This alternative would not produce any short- or long-term visual contrasts, or directly change the project area's existing disturbances as viewed from all inventoried moderately and highly sensitive travel routes and viewpoints. Visual quality objectives would not negatively be affected to the scale or intensity that would detract from its natural or socially-valued appearance.

Long-term indirect effects may include gradually decreasing views into the forest understory, or decreasing views from open viewpoints as seen from former landing sites, or along line-of-sight vistas, as seen from road and riparian corridors. Barring any major future natural or cultural disturbances, a combination of natural and culturally-created openings along ridgelines, as seen in middleground and background views may gradually decrease in size, eventually creating the appearance of an unbroken forest canopy. Project area existing visual disturbances that are noticeable from all viewing distances may generally reduce over time through revegetation, in the absence of future human or natural disturbances.

Additional long-term effects include the general decrease of vegetation structural diversity over time, and the density of vegetation would increase through cumulative growth cycles. The effects of Alternative 1 will negatively move the analysis area for this indicator further away from what is identified as its ecologically-established landscape character. All visual quality objectives will be unaffected by this alternative.

With increased vegetation density, there will be the potential decline of fire-adapted vegetation, as well as the decline of forest ecological resiliency to insects and disease. Within the project area and beyond, the probability will increase for future strong landscape visual contrasts created by non-ecologically or historically established high-severity wildfire, insect infestation outbreaks, or a combination of insect infestation and subsequent tree mortality, followed by high-severity wildfire events. These potential events could negatively affect the natural or socially-valued appearances of visual quality objectives.

Cumulative Effects

Adding the effects of Alternative 1 to the effects of the past, current and reasonably foreseeable future actions described in Appendix C will not result in measureable cumulative effects on scenery.

Alternatives 2 and 3

Direct and Indirect Effects

Alternative 2 proposes treatments on approximately 36 percent of the project area's 29,500 acres through a combination of fuel breaks, brush mastication, underburning, and thinning with and without forest product removal. Alternative 3 proposes treatments on approximately 38 percent of the Project area's 29,500 acres through a similar combination of fuel breaks, brush mastication, underburning, and thinning with and without forest product removal as seen in Alternative 2; however, there will be an acreage increase proposed for fuel breaks and thinning without removal, and acreage decrease for mastication and thinning with removal. Additionally, there will be a decrease in temporary roads for Alternative 3. See chapter 2 for specific details. For scenic resources, the direct and indirect effects will be the same for Alternative 2 and Alternative 3.

Collectively, these treatments will create minor short-term visual contrasts, along with short- and long-term scenic resource and ecosystem benefits, and will not negatively affect visual quality objectives to the scale or intensity that would detract from its natural or socially-valued appearance. These benefits will visually improve the spatial and structural characteristics of scenic resources, as well as increasing insect, disease and fire resiliency of those treated portions of the forest. Desired visual characteristics include a more diverse vegetation structure as well as a more open forest understory, which are two of the attributes the general public considers aesthetically pleasing. These characteristics benefit from the improved forest ecological function that will be a result of implementing the treatments in Alternative 2 or 3. Increased tree spacing will increase resilience to insect and disease outbreaks and wildfire, and the same irregular spatial structure will mimic the ecologically-established landscape character historically created by a low-mixed severity fire regime.

As previously mentioned in the methodology section above, although the short-term visual evidence of low-intensity (and the assumption of medium and high-intensity) prescribed burning is generally perceived as negative, the short and long term ecological benefits outweigh these negative short-term visual perceptions.

Foreground view effects: short-term direct and indirect management effects in foreground views for all project area visual quality objectives, as seen from Forest Plan inventoried viewpoints, trails, and along designated highly and moderately traveled roads. These may include tangible and intangible elements associated with active forest management during project implementation, such as harvesting activity, noise, dust, and traffic along haul routes. Additional short-term effects include the change in vegetation density and spacing during and immediately upon project completion, cut stumps, tree paint and flagging as seen from project area trails and moderately-traveled roads, exposed soils (such as decomposed granite, which tends to have a greater visual color contrast than the surrounding terrain), large concentrated slash piles in new and existing landings or along trails and moderately traveled roads, skyline corridors and ground-based units, as well as linear evidence of skyline corridors, as expressed through soil disturbance. Additional short-term effects from underburning include tree bole (trunk) scorching, mortality of small trees, and mosaic burn patterns on the forest floor.

Long-term effects in foreground views for all project area visual quality objectives may include cut stump patterns as seen from project area non-designated high and moderately

sensitive (traveled) roads, tree paint and flagging, exposed soils with greater visual color contrasts than surrounding terrain, large concentrated slash piles in new and existing landings or along trails and roads, skyline corridors and ground-based units, as well as linear evidence of skyline corridors.

Long-term underburning effects will gradually decrease over time, as will the contrast change in vegetation massing, as vegetation growth responds to increased sunlight in the gaps.

Short-term effects in middleground and background views for all project area visual quality objectives may include: change in vegetation massing (form and texture, when contrasted against non-treated stands), exposed soils from landings, and linear evidence (seen in both line and color contrast) of skyline corridors or skid roads and existing road alignments exposed by a decrease in vegetation.

Long-term effects in middleground and background views for all project area visual quality objectives may include change in vegetation massing (form and texture, when compared against non-treated stands), linear evidence of skyline corridors or skid roads and existing road alignments exposed by a decrease in vegetation.

Project design features will guide the implementation of treatments so the respective visual quality objectives will be met within the designated time-frame, especially those foreground areas along designated moderate sensitivity roads, trails, and forest plan-designated viewpoints, and in middleground views as seen from the Yreka community and surrounding area. Overall, the quality of the ecologically-established landscape character will be improved through Alternative 2 or 3 treatments.

Cumulative Effects

Past actions are described in the affected environment section above. The following are ongoing and reasonably foreseeable future actions considered within the project area that have bearing on scenic resources and the analysis indicator.

There are no ongoing actions by the Forest Service within the project area, other than current ongoing use and maintenance of roads and trails.

The Badger timber harvest plan will treat approximately 48 acres through a combination of clearcutting and shelterwood removal with tractor logging. Located along the north slope of Badger Mountain, it is expected that there will be strong line visual contrasts associated with this project between 10 and 20 years after it is complete, or until the vegetation grows to the extent to reduce the contrasts. The public may be able to view these contrasts from California State Highway 96 coming eastbound in the western vicinity of the Tree of Heaven Campground, but this depends on the actual location of the harvest units. Due to topography, Alternative 2 or 3 treatments for the Craggy Project will not be seen in combination with the Badger timber harvest plan treatments. Additionally, with project design features, Alternatives 2 and 3 will not induce non-natural line or textural visual contrasts, and will not negatively affect visual quality objectives to the scale or intensity that would detract from its natural or socially-valued appearance.

Therefore, no cumulative effects in time and space are expected in association with the Badger timber harvest plan.

3.11.6 Comparison of Alternatives

Table 3-53: Scenery Comparison of Effects

Indicator	Alternative 1	Alternatives 2 and 3
Visual Quality Objectives	Existing visual disturbances are minor and widespread. This alternative meets the Forest Plan thresholds for all sensitive views. There will be no new visual impacts; however there will be increasing future risk for ecosystem disturbances, such as high-severity wildfire, and insect outbreaks.	There will be widespread new minor visual disturbances within designated viewsheds for 1-3 years. With project design features, Forest Plan visual quality objective thresholds for all designated views and road/trail travel corridors will be met.

3.11.7 Compliance with law, regulation, policy, and the Forest Plan

Alternatives 2 and 3 will comply with relevant law, regulation, and policy. Alternative 1 will negatively affect the project area's existing scenic resources and will continue the trend away from vegetation spatial patterns established by a low to mixed severity fire regime, which is not consistent with Forest-wide Klamath National Forest Plan Standard 11-4, which gives direction to "perpetuate the ecologically established landscape character."

3.12 Recreation

3.12.1 Methodology

The effects of the Craggy Project on recreation are based on recreation opportunity spectrum classes and place-based settings in the project area. Available literature review, professional judgment, geographic information system data and other software were used to identify the affected environmental and environmental consequences for recreation.

3.12.2 Analysis Indicators and Measures

Indicator

Determining if the project will alter the recreation opportunity spectrum (ROS) settings (place-based physical settings) designated in the Forest Plan for the project area.

Measures

Designated ROS classes for the project area are (1) rural and (2) roaded natural. A rural area is characterized by a substantially modified natural environment. A roaded natural area is characterized by predominantly natural-appearing environments with moderate evidence of the sights and sounds of man; such evidence usually harmonizes with the natural environment.

3.12.3 Spatial and Temporal Bounding of Analysis Area

The spatial bounds for analyzing direct, indirect, and cumulative effects for recreation resources is the boundary of the Craggy project area.

The temporal bounds are defined by the expected time frame for project implementation which may occur over a few years (approximately one to five years) from beginning to end. Longer term effects are not expected for recreation resources.

3.12.4 Affected Environment

Recreational opportunities and uses include camping at three designated dispersed (without formal improvements) sites, hunting, driving for pleasure, viewing scenery, and collecting forest products. These opportunities occur on the Humbug Off-Highway Vehicle open riding area which includes a children's riding area, a day use area, and a vault toilet, and on approximately 14 miles of trail and a number of Forest system roads available for motorized vehicle use. One recreation special-use event occurs within the project area during the Memorial Day weekend, when the Siskiyou County Off-Road Riders hosts the annual Craggy Mountain Poker Run on Saturday and Sunday.

The three dispersed camps in the project area exist in the *roaded natural* recreation opportunity spectrum setting. 51D025 and 51D028 are located along the western ridgeline of the project boundary. 51D027 is located about one mile west of the Badger Mountain summit. All three camps are above 4,500 feet in elevation, are most likely occupied during the hunting season, and are typically accessed by short routes which are "open to all vehicles," as displayed on the 2012 Motor Vehicle Use Map and identified with road signs.

Within the project area, only two recreation opportunity spectrum settings are classified: Roded Natural and Rural. The majority of the area is classified as Roded Natural, and the minority is Rural.

The majority of the existing recreational setting is consistent with the classification of Roded Natural. The majority of the environment appears natural, with cultural disturbances scattered throughout, such as roads, evidence of past mining, logging, past terrace forestry, and year-round or seasonal residences on private inholdings. In general, the cultural disturbances and resource modification and utilization practices, although evident, generally harmonize with the natural environment.

The Rural classification also applies to the project area. These areas display substantial modification and utilization, and in the case of the Humbug Off-Highway Vehicle area (which is classified in both categories), exhibits the characteristics of the Rural classification. These Rural characteristics include physical developments specifically for larger group size motorized recreation within the designated riding area. Away from the more developed designated riding area, the recreating public experiences the Roded Natural classification, with more natural appearing physical settings along the designated trail system.

Recreation resources and recreation opportunity spectrum settings for the Project are depicted on the maps in Appendix A of the Recreation Report.

3.12.5 Environmental Consequences

Alternative 1

Direct and Indirect Effects

There would be no substantial changes to the existing Forest Plan designated ROS physical or experiential settings to the project area. There would be no direct or indirect effects of management from thinning, mastication, creation of fuel breaks, or underburning. Existing recreational use and distribution patterns are anticipated to continue.

Cumulative Effects

Because there are no direct or indirect effects to designated ROS settings, recreation use or distribution anticipated under Alternative 1, there will be no cumulative effects for this alternative.

Alternatives 2 and 3

Direct and Indirect Effects

Professional judgment determines there will be no direct or indirect alterations to the existing ROS settings designated in the Forest Plan activities associated with Alternative 2 or 3. Both ROS settings are characterized by resource modification and utilization practices, and all proposed actions for both alternatives will harmonize with the natural environment over time.

Effects upon the dispersed campsites are the same for both Alternatives 2 and 3. Dispersed Camps 51D025 and 51D028 may be directly affected by thinning operations, necessitating temporary public safety closures. 51D025 would be affected by Units 134-107 and 134-34, as well as fuelbreak treatments. 51D028 would be affected by Unit 134-33, fuelbreak treatments, and Underburn Unit-1. 51D027 may be affected by fuelbreak treatments only.

For Alternatives 2 and 3, underburning operations associated with Underburn Unit 1 and thinning with forest product removal operations associated with Unit 134-240 would cause temporary public safety closures along Trail 96.

For Alternatives 2 and 3, thinning without forest product removal operations associated with Unit 138-56 will temporarily close Trail 109.

For both Alternatives 2 and 3, the combination of fuelbreak treatments, Underburn Unit-1, and both kinds of thinning operations associated with Units 134-55, 134-245, 134-244, 134-58, 134-242, and 133-89; would temporarily close Trail 94 for short periods. Table 3-54 below displays the recreation resources that are directly affected by the proposed project treatments.

Table 3-54: Recreation Resources Directly Affected by Proposed Project Treatments

Recreation Resource	Miles	ROS	Proposed Alternative 2 Treatments Within or Directly Adjacent to Recreation Resources
Trail 5594 (94)	2.6	Roaded Natural	Units 134-55, 134-244, 134-245, 134-58, and 134-242, 133-89; fuelbreak treatments, and Underburn Unit-1
Trail 5596 (96)	3.0	Roaded Natural	Underburn Unit-1 and Unit 134-240
Trail 55109 (109)	0.3	Rural	Unit 138-56
Dispersed site accessed by 51D025	N/A	Roaded Natural	Units 134-107, 134-34, and fuelbreaks treatments
Dispersed site accessed by 51D028	N/A	Roaded Natural	Unit 134-33, fuelbreak treatments, and Underburn Unit-1
Dispersed site accessed by 51D027	N/A	Roaded Natural	Fuelbreak treatments

Cumulative Effects

See Appendix C for more detailed information about ongoing and reasonably foreseeable future actions considered for cumulative effects for the Craggy Project. Effects from current management activities, such as the use and maintenance of roads and trails, are consistent with Recreation Opportunity Spectrum classification thresholds.

The Badger Timber Harvest Plan, currently being implemented by the Michigan California Timber Company, is treating approximately 48 acres through a combination of clearcutting and shelterwood removal with tractor logging. Located along the north slope of Badger Mountain, this project may affect dispersed site 51D027 (in the *roaded natural* setting) as it exists immediately along the main timber haul access route, but is not expected to affect overall Recreation Opportunity Spectrum classification thresholds in conjunction with the Project.

3.12.6 Comparison of Alternatives

Table 3-55: Comparison of Effects on Recreation Analysis Indicators for all Alternatives

Indicator	Alternative 1	Alternatives 2 and 3
Designated Recreation Opportunity Spectrum classifications for all Management Areas in the project boundary.	Overall designated Recreation Opportunity Spectrum classification thresholds would not change, as project treatments would not be implemented.	Overall designated Recreation Opportunity Spectrum classification thresholds would not change overall due to any proposed treatments, and will remain consistent with Forest plan direction.

3.12.7 Compliance with law, regulation, policy, and the Forest Plan

Proposed action alternatives for the Craggy Project will meet and maintain all of the designated recreation opportunity spectrum settings for all management areas in the project area. Save for temporary closures during implementation, all proposed alternatives are not expected to impact the overall dispersed and seasonal nature of recreational opportunities within the boundary. Integration of recreation project design features assures this Project is consistent with the Forest Plan, law, policy and regulation.

3.13 Heritage Resources

3.13.1 Methodology

The Forest is required to take into account the effects of all Forest undertakings on historic properties pursuant to Section 106 of the National Historic Preservation Act and the Programmatic Agreement among the USDA Forest Service, Pacific Southwest Region (Region 5), California State Historic Preservation Officer, Nevada State Historic Preservation Officer, and Advisory Council on Historic Preservation Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Management of Historic Properties by the National Forests of the Pacific Southwest Region (Regional PA). The following summarizes the effects of implementation of the Craggy Project on historic properties located within the project area.

The methodology used for this analysis consists of two components. The first is determining the area within which implementation of an alternative has the potential to have an effect.

The second is establishing whether or not there are historic properties present within this area which may be affected by Project implementation.

Establishing the area within which there is potential to have an effect resulted in the development of the Area of Potential Effect. The Area of Potential Effect was developed primarily based upon the actions associated with proposed alternatives. The Area of Potential Effect was also used to guide efforts associated with historic property identification.

Identification of historic properties within the Area of Potential Effect forms the second component of analysis. This effort involved three elements: pre-field research, field surveys, and consultation. Pre-field research involved a thorough review of existing and available information on known historic properties within the Area of Potential Effect. Field surveys were conducted within the Area of Potential Effect to locate and identify any previously unknown historic properties. Consultation efforts included soliciting information on historic properties from tribal organizations, the general public, and within the Forest Service.

3.13.2 Analysis Indicators and Measures

Impacts are assessed using criteria defined by regulations for Protection of Historic Properties (36 CFR Part 800). If an action could change in any way the characteristics that qualify the resource for inclusion on the National Register for Historic Places, it is considered to have an effect. An effect is a direct or indirect alteration of the characteristics of a historic property that qualifies it for inclusion on the National Register of Historic Places.

Effects to historic properties are classed into four categories based upon relative intensity:

- **Negligible:** The effect on archaeological sites would be at the lowest levels of detection—barely measurable with any perceptible consequences.
- **Minor:** The effect on archaeological sites would be measurable or perceptible, but it would be slight and localized within a relatively small area for a site or group of sites.
- **Moderate:** The effect would be measurable and perceptible. The action would change one or more character-defining features of a resource, but it would not diminish the integrity of the resource to the extent that its National Register of Historic Places eligibility would be jeopardized.
- **Major:** The effect on archaeological sites would be substantial, noticeable, and permanent. For National Register of Historic Places eligible or listed archaeological sites, the action would change one or more character-defining features of an archaeological resource, diminishing the integrity of the resource to the extent that it no longer would be eligible for listing on the National Register of Historic Places.

3.13.3 Spatial and Temporal Context

The spatial bounding of the analysis area for the Craggy Project is the Area of Potential Effect. The Area of Potential Effect is defined as any area within the Project in which activities are proposed to occur, as well as areas utilized in support of those activities. The Area of Potential Effect differs from the more general project area in that it specifically refers to localized areas in which project-related activities are proposed. The Area of Potential Effect is used for effects analysis rather than the project area because archaeological sites are static resources. Because these resources are present at fixed locations, an action has to occur

at or near that location to cause an effect. Thus, the Area of Potential Effect refines the analysis to only areas which are identified for actions in order to eliminate extraneous analysis.

Temporal bounding of this analysis is composed of two effects classifications: short- and long-term. Short-term effects are those which occur during or up to the first five years following implementation. Long-term effects are those which occur after the five year period following implementation. Effects are classified as short- and long-term in order to distinguish between those effects most immediately associated with Project implementation relative to effects considered for indefinite resource management purposes.

3.13.4 Affected Environment

The Craggy Project is located within an area known to have historic archaeological sites. Thirty-two archeological sites have been identified within the Area of Potential Effect. Archaeological sites are irreplaceable resources; damage or destruction of sites is permanent and irreversible.

The project area is within the Shasta ancestral territory. No traditional cultural properties, traditional or contemporary use areas, or specific areas of spiritual significance have been identified within the Area of Potential Effect of this project.

3.13.5 Environmental Consequences

Alternative 1

Direct and Indirect Effects

Implementation of Alternative 1 proposes that no management actions be taken. Therefore, there will be no direct effects to sites. However, with the implementation of this alternative, the potential for indirect effects may be increased. The increase in potential for indirect effects stems from leaving a higher vegetative fuel loading within sites and surrounding areas.

Leaving a higher fuel loading within a site increases the risk that the site will burn more intensely during a wildfire. Intense fire may damage or destroy combustible artifacts or permanently alter materials susceptible to heat or flame within a site. The effects from fire are difficult to predictively analyze since they are specific to an individual site, fire behavior, and fuel conditions. Fire effects are also difficult to anticipate because it is not known where, when, or under what conditions they might occur. Potential indirect effects from wildfire may range from negligible to major through the short and long term.

Implementation of Alternative 1 will not necessarily result in the indirect effects described above. However, it may increase the potential for these effects to occur by creating conditions which give rise to a higher probability of such effects occurring.

Cumulative Effects

Fuel loading within and adjacent to the boundaries of historic properties will not change as a result of future actions outside the Area of Potential Effect. Taking no management actions in the project area, in combination with past, present and reasonably foreseeable future actions, will not result in cumulative effects to historic properties.

Alternative 2

Direct and Indirect Effects

Standard Resource Protection Measures as outlined in Appendix E of the Region 5 Programmatic Agreement will be used in this alternative to avoid direct effects to sites. However, use of protection measures may increase the probability for indirect effects in both the short and long term.

Implementation of Alternative 2 involves taking actions that have the potential to affect archaeological sites. However, using Standard Resource Protection Measures referred to as project design features during implementation, when effectively applied, will prevent any direct effects to historic properties. The Standard Resource Protection Measures or project design features for this undertaking include the physical demarcation and avoidance of all historic properties during implementation. Where appropriate and when approved by the district archaeologist, protection measures may include the removal of fuels from within historic properties when removed by hand, and when piled and burned outside the boundaries of these properties.

Indirect effects of implementing Alternative 2 may result even with the application of project design features. Use of project design features to mitigate direct effects to sites may promote conditions where indirect effects are more likely to occur. As an effect of avoiding historic properties, pockets of vegetation are formed that are clearly visible on the landscape. These pockets both draw attention to the site and have higher fuel loads compared to surrounding areas; both of these increase the potential for indirect effects on the properties.

An increase in site visibility in turn increases the likelihood that sites will be subjected to looting and vandalism. The effects from these types of impacts are difficult to predictively analyze since they are specific to an individual site and situation. They are also difficult to anticipate because it is not known where or when they might occur, or to what extent. Potential indirect effects from looting or vandalism may range from negligible to major through the short and long term.

Leaving a higher fuel loading within a site increases the risk that the site will burn more intensely during a wildfire than does the surrounding area. Intense fire may damage or destroy combustible artifacts or permanently alter materials susceptible to heat or flame within a site. The effects from fire are difficult to predictively analyze since they are specific to an individual site, fire behavior, and fuel conditions. Fire effects are also difficult to anticipate because it is not known where, when, or under what conditions they might occur. Potential indirect effects from wildfire may range from negligible to major through the short and long term. However, when fuels can be removed from within historic properties as provided in the project design features, the potential for indirect effects decreases, albeit by an unquantifiable amount.

Implementation of Alternative 2 will not necessarily result in the indirect effects described above. It may increase the potential for these effects to occur by creating conditions which give rise to a higher probability of such effects occurring.

Cumulative Effects

Because effects to archaeological sites are location-specific, implementation of past, present, and reasonably foreseeable future actions associated with other projects will not result in a

cumulative effect to sites within the Area of Potential Effect for the Craggy Project unless those actions occur within site boundaries. There are no ongoing or future actions that overlap with the Area of Potential Effect within the Craggy project. At this time, the project design features eliminate the possibility of present or upcoming actions taking place within the boundaries of sites in the Craggy Area of Potential Effect. Therefore, implementation of Alternative 2 will not have a cumulative effect on archaeological sites within the Area of Potential Effect.

Alternative 3

Direct and Indirect Effects

Alternative 3 is the same as Alternative 2 except treatments will occur on an additional 710 acres. Implementation of project design features will protect heritage resources on these additional acres as described in Alternative 2; the direct and indirect effects of Alternative 3 are the same as for Alternative 2.

Cumulative Effects

Cumulative effects of Alternative 3 on heritage resources will be the same as for Alternative 2.

3.13.6 Comparison of Alternatives

Implementation of Alternative 1 would result in no direct or cumulative effects to archaeological sites within the Area of Potential Effect although it may increase the potential for indirect effects over the short and long term. Implementation of Alternative 2 or 3 would not result in any direct or cumulative effects to sites but these alternatives may also result in an increased potential for indirect effects over the short and long term. Comparison tables in chapter 2 display the acreage on which treatments are proposed that may affect heritage resources. Because implementation of Alternative 2 or 3 only increases the potential for these effects, the nature and extent of such effects cannot be effectively analyzed or predicted. Therefore, indirect effects from Alternatives 2 and 3 are not fully understood as these effects, if they were to occur at all, will result from unanticipated or uncontrolled events occurring independently of management decisions. Since project design features to mitigate effects to heritage resources will be applied for Alternatives 2 and 3, no measurable negative direct effects to heritage resources are expected for these alternatives.

3.13.7 Compliance with law, regulation, policy and the Forest Plan

Regardless of the alternative selected, historic properties identified within the project area will be managed in accordance with the guidelines set forth in the *Programmatic Agreement Among the U.S.D.A. Forest Service, Pacific Southwest Region (Region 5), California State Historic Preservation Officer, Nevada State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Management of Historic Properties by the National Forests of the Pacific Southwest Region (Region 5 PA)*. Management of historic properties according to the provisions set forth in the Region 5 PA is consistent with Forest Plan direction, as displayed in the Forest Plan Consistency Checklist, and is in compliance

with the National Historic Preservation Act. Therefore, implementation of the Project is consistent with Forest Plan direction and in compliance with law, regulation, and policy.

3.14 Social and Economic Resources

The purpose of this section is to analyze the effects of the Craggy Project on social and economic health, and identify any disproportionate effects to minorities and disadvantaged groups, in Siskiyou County.

3.14.1 Methodology

Social

Information from federal data sources is used to compare the social status of Siskiyou County to the State of California and the United States to provide background information for effects of the project on minorities and disadvantaged groups. The Economic Profile System, Human Dimensions Toolbox, compiles statistics from federal data sources and is used as a source of information for this analysis.

Social and Civil Rights analysis is based on the quality of life of people affected by this project. Safety is an important value to people in Siskiyou County and an important part of quality of life; therefore, one purpose of this analysis is to gain a better understanding of how safety relates to the purpose and need of this project and its proposed actions. Quality of life also depends on an economic element, for people to sustain themselves and their families, which is analyzed in the economic portions of this document.

Economic

Forest Service created models were used to analyze economic effects comparisons between alternatives proposed by the Craggy Vegetation Management Project. These models assist in a cost-benefit socio-economic analysis based on the proposed treatments of each alternative. Two different economic models were used: (1) the Region 5 Timber Sale Economic Evaluation model and (2) the Treatments for Restoration Economic Analysis Tool (TREAT) model. The Region 5 Timber Sale Economic Evaluation model calculates the approximate residual value of the timber sale to the purchaser after completion of the project. The TREAT model calculates approximate present net value which is shown as potential employment in number of jobs and the potential income these jobs may provide. These models will provide an effective comparison between Project alternatives concerning economic resources, in particular the volume and value of forest products and employment and labor income provided in the timber products sector. To provide input to the model, the approximate volume per acre of forest product removals was calculated, for each alternative, by the district silviculturist using the Forest Vegetation Simulator (FVS). Inputs such as haul distance, skid distance, slope, and road and landing construction were developed by local knowledge of the project area and spatial analysis in ESRI ArcGIS software. Annual forest product volumes and sold values were retrieved from the Forest Products Cut and Sold database (USDA 2016a). All calculations and models are a best estimate and may differ from actual results.

3.14.2 Analysis Indicators and Measures

Social

Social and Civil Rights analysis is based on the quality of life of people affected by this project.

The indicators used for the social analysis include lifestyles, values, beliefs, health and safety of individuals and communities. For this project, there are two measures for evaluating the effects of the project on quality of life for Siskiyou County residents:

1. The value of using the resources of the Forest, and project area in particular, for the benefit of county residents (Siskiyou County Land and Resource Management Plan 1996). This will be analyzed by the jobs provided and value of the estimated volume of timber products the action alternatives will produce. Other beneficial uses are discussed in other resource reports, especially in the aquatic resources, hydrology, recreation, and wildlife reports.
2. Changes to the “fire-safe character of communities” in the project area. This will be analyzed by the acres of treatment, primarily fuels treatments, and location of treatments in relation to private property in each alternative. It is assumed that treatments, primarily but not exclusively fuels treatments, have the indirect effect of creating more fire-safe communities.

Assumptions made in this analysis include that it is probable that any portion of the project area will be accessed by the public, firefighters, or Forest workers.

Economic

The Forest Plan includes a Forest-wide goal to promote the economic stability of local communities (Forest Plan page 4-9). Economic analysis indicators for this report are:

- 1) Revenue generated based on forest product value,
- 2) Employment supported; and
- 3) Direct labor income revenue generated.

3.14.3 Spatial and Temporal Bounding of Analysis Area

Siskiyou County is used as the spatial analysis area for social effects and for fiscal effects (timber receipts) because the project area is entirely within the county and data are available at this scale. Siskiyou County will be used as the analysis area for economics because the project’s direct economic effects through manufacturing, logging, log hauling and forestry support services are primarily realized through this larger area. Although direct effects to safety, and treatments proposed to improve safety, are entirely within the project area, overall safety of communities outside the project area such as Yreka may be affected so the boundaries of the eight 7th field watersheds are used to analyze safety.

This analysis considers one to five years as the short-term time period for effects analysis on safety and other social and economic indicators. This temporal bounding approximates when treatments would be completed and products from implementation have entered the wood products market. Five to ten years is the long-term time period for effects analysis on safety

and other social and economic effects because the majority of social and economic effects are not likely to be noticeable after that time period.

3.14.4 Affected Environment

The closest sizeable community to the project area is the City of Yreka which is located one mile east of the project area. Fort Jones is within 10 miles south of the project area. Some private residences and property occur within the project area. Much of the project area is within the wildland urban interface, an area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. The density of vegetation, discussed in the Silviculture Resource Report, and the potential for high severity wildfire, discussed in the Fire and Fuels Resource Report, provide support for the concern that wildfires would destroy or damage residences in this area.

According to the latest demographic results from the Economics Profile of Siskiyou County (USDA, USDI and Headwaters 2016), the Siskiyou County population consists of Caucasian, African American, American Indian, Hispanic, Asian, Native Hawaiian or Pacific Islander, and other races. The American Indian population is a greater percentage of the population in Siskiyou County than in the State of California. A larger percentage of the population of Siskiyou County is unemployed or below the poverty line than in the state of California or the United States as a whole. From 1970 to 2014, employment grew from 14,085 to 20,478 jobs, about a 45 percent increase from 1970. The number of jobs in 2014 is the same as in 2000. A high in population and employment was reached in 2010 and has declined slightly since then. Since 1990, the annual unemployment rate ranged from a low of 7.5 percent in 2000 to a high of 16.6 percent in 2010; the unemployment rate for 2015 was 9.4 percent compared to 6.2 percent for the United States. Labor income in Siskiyou County has held relatively constant since 1970; non-labor income has been on a steady rise and was almost 57 percent of personal income in 2014. Unlike the nation as a whole, the highest average annual wages in Siskiyou County are for government-related jobs.

Lifestyles, attitudes, beliefs and values of Siskiyou County residents are similar to those of rural residents in other counties in the western United States (Siskiyou County 2005). Many local residents depend on the environment to support them, and they want forest products to be used for the benefit of the county. The concern regarding the fire-safe character of the communities in and adjacent to the project boundary and for the general safety of the public, forest workers, and firefighters is high. Conditions related to safety have changed in the last few years due to drought and high intensity wildfires that have left many acres of the Forest in an unsafe condition and are of particular concern to communities within and adjacent to the project area boundaries.

In 1998, timber represented more than seven percent of total employment of Siskiyou County; by 2014, timber represented less than six percent of total employment. The percentage of total employment in the nation as a whole related to timber is less than one percentage. Jobs in the timber sector in the county decreased to about 480 jobs in 2014. "Although National Forests account for more than 60 percent of the county's land base, the share of the county's timber harvest off federal lands has decreased from roughly 50 percent to less than 20 percent since the northern spotted owl was listed as threatened in 1990. Since 1990, the number of wood products manufacturing facilities in the county has declined by half" (Dennis 2012).

2015 is the most recent year for which data is available on timber products sold by the Forest (USDA 2016a). It also was the highest producing year in both volume and value over the five-year period (Figure 2). In fiscal year 2015 (October 2014 – September 2015), forest product sales amounted to about 7,897,900 cubic feet for a sold value of \$1,780,200 (\$0.23 per cubic foot). Average sold value for forest products over the 2010-2015 period are \$0.15 per cubic foot. Volumes sold over this period have fluctuated, often due to emergency salvage of trees killed by wildfire, but averaged about 6,500,000 cubic feet. Planned annual targets for 2014 to 2016 have been slightly lower, ranging from 4,800,000 to 6,000,000 cubic feet. The Forest has set annual forest product volume targets for 2016 to 2018 at 5,400,000 cubic feet per year, well within the allowable sale quantity of 7,600,000 cubic feet sawlog volume established by the Forest Plan (USDA 1995). The value of the annual forest product volume target is estimated to be \$810,000 per year based on the average selling rate. This is lower than the five-year average of \$988,000 per year. As evidenced by the five-year averages, the Forest has a record of exceeding targets on both value and volume of forest products offered to the public.

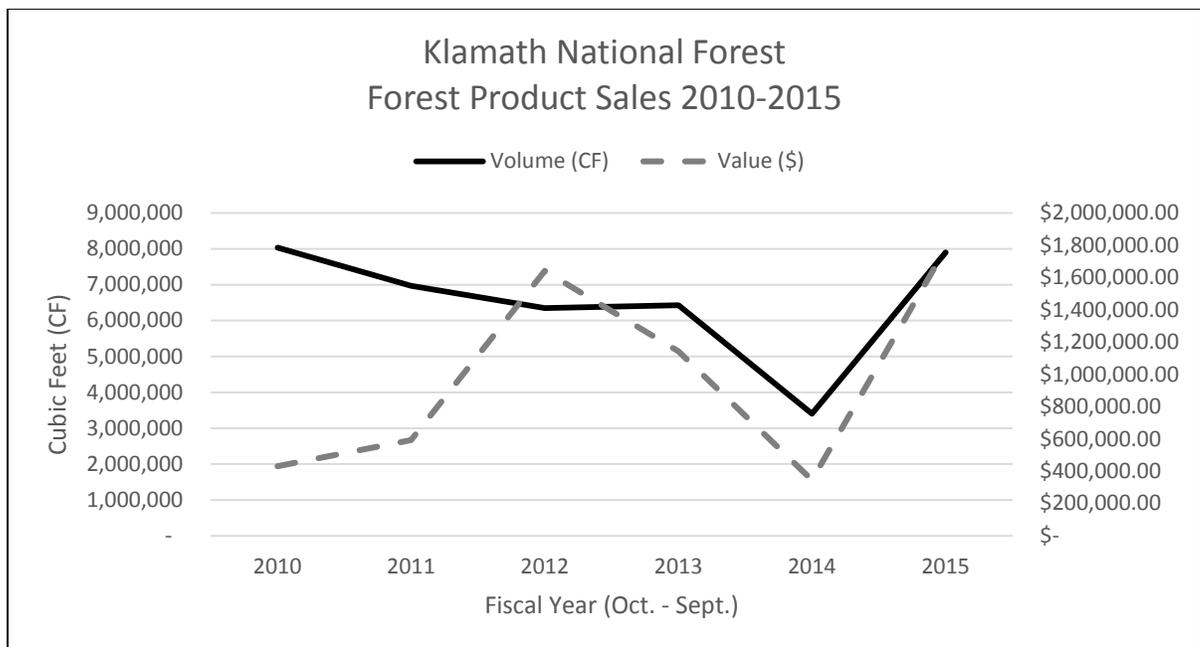


Figure 2: Forest Product Sales by the Klamath National Forest.

For 2014, the Forest is estimated to have supported 232 direct jobs in the timber products sector. This employment represents a direct labor income of \$10,611,000 (USDA 2016b). The estimate of labor income includes income to sole proprietors of businesses. Employment has slightly increased over the five year period from 2009 to 2014 with 158 jobs as the five-year average. Labor income followed the same trend with a five-year average of \$8,114,000 (Figure 3).

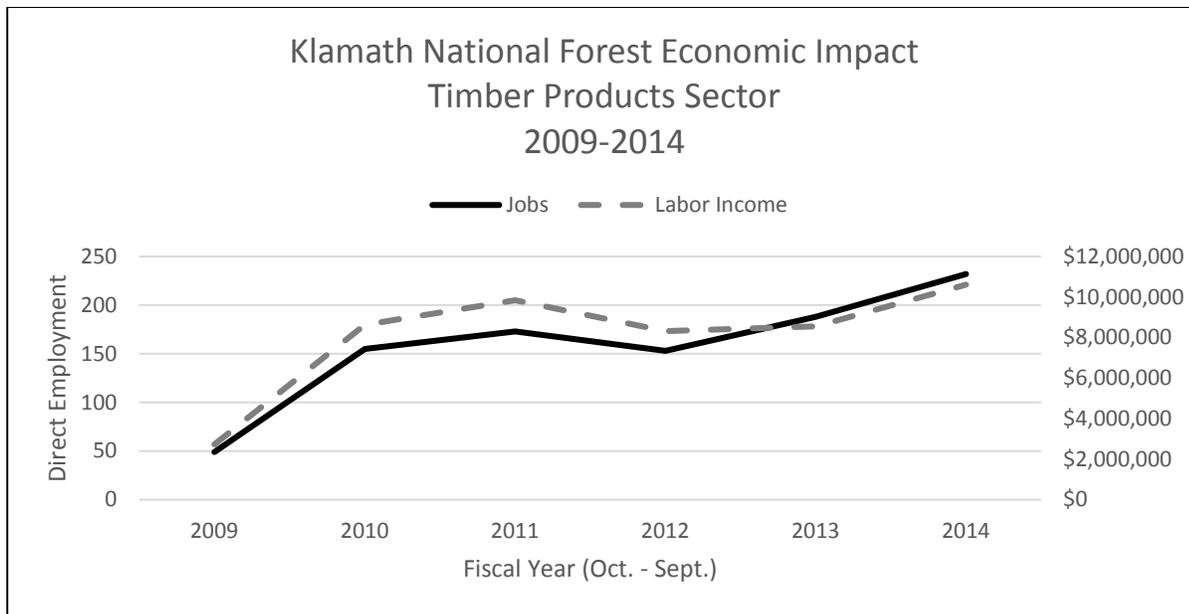


Figure 3: Direct Employment and Labor Income Supported by the Klamath National Forest.

3.14.5 Environmental Consequences

Alternative 1

Direct and Indirect Effects

Social

Under this alternative, no treatments would be implemented so there would be no change from the current situation in terms of the use of resources of the project area for the benefit of Siskiyou County residents and property owners in the short term or long term. Without any treatments being implemented in this alternative, the fire-safe character of residents, property owners, or communities within or adjacent to the project area would not improve in the short term. In the long term, fire safety is expected to decrease with no treatment since dense vegetation would continue to grow and the likelihood of high intensity wildfire would increase (see the Fire and Fuels Resource Report for additional information). There would be no disproportionately high and adverse human health or environmental effects on American Indians or those below the poverty level.

Economic

This alternative has no economic impacts because no treatments generating economic effects would be implemented. No forest products or revenues would be generated from timber sales. Similarly, no employment or labor income is created as a result of this alternative. Volumes and values of sold forest products are estimated to remain within the range of past variability as the Klamath National Forest makes administrative decisions on how to meet forest product targets.

Cumulative Effects

Social

Adding the effects of past, current and reasonably foreseeable future actions as noted in Appendix C to the effects of no treatment in this alternative would not have significantly cumulative effects on the use of resources for the benefit of Siskiyou County nor on the fire-safety of communities.

Economic

Adding the effects of past, current and reasonably foreseeable future actions as noted in Appendix C to the effects of no treatment in this alternative would not have significantly cumulative effects on revenue generated, employment, or labor income.

Alternative 2

Direct and Indirect Effects

Social

Under this alternative, treatments that provide revenue to the County would be implemented on about 2,870 acres. This would increase the use of resources of the project area for the benefit of Siskiyou County residents and property owners in the short term. The fire-safe character of residents, property owners, or communities within or adjacent to the project area would be improved on a total of about 10,600 acres in the short term. Of these acres, 1,400 would be in fuel breaks (including 60 adjacent to private property), 4,160 in prescribed underburning, 900 in mastication, 1,270 in thinning without product removal, and thinning with removal of forest products on about 2,870 acres (these 2,870 acres are the same ones that would provide revenue and use resources as mentioned above). In the long term, fire safety is expected to increase since dense vegetation would be thinned and the likelihood of high intensity wildfire would decrease (see the Fire and Fuels Resource Report for additional information). There would be no disproportionately high and adverse human health or environmental effects on American Indians or those below the poverty level.

Economic

Alternative 2 would make available an estimated 3,305,500 cubic feet of forest products, with 68 percent of this volume as sawlog products. Other products include biomass for energy generation and commercial firewood. This amounts to 55 percent of the 5,400,000 cubic feet annual target planned for the Forest. The appraised base value of these forest products, subtracting logging and hauling costs, is estimated at \$158,300 (Region 5 Timber Sale Economic Evaluation model). Although 55 percent of the planned volume, the value amounts to only 20 percent of the projected \$810,000 annual value of forest products sold by the Forest. The difference between relative value and relative volume of forest products produced by the alternative is due to the proportion and value of sawlog products. In this alternative, much of the thinning with forest product removal would occur in 40 to 50 year old plantations which have lower stocking of sawlogs relative to older natural stands and are composed primarily of ponderosa pine, a low economic value species. Further information on the size and species of trees anticipated for removal may be found in the Silviculture Resource Report.

Direct employment in the timber products sector supported by forest product removals is estimated at 45 jobs with a direct labor income value of \$1,919,300. This employment would be supported for the period of four years which is the estimated period over which forest products would be produced and jobs created. The majority of employment is in mill processing (32 jobs) and timber harvesting (10 jobs). The direct labor income value includes the compensation and benefits for employees, as well as the income earned by sole proprietors of businesses employed in implementation. Direct employment through this project is estimated at 28 percent of total jobs annually supported in the timber products sector by the Forest, based on the five-year average of 158 jobs. Labor income value is the same proportion, about 24 percent of the approximately \$8,114,000 in direct labor income supported by the Forest.

Alternative 2 has an overall positive economic effect. The planned forest product outputs would be about half of the annual target of the Forest, although they would yield only a fifth of the relative total value. Direct employment and labor income in the timber industry supported by this alternative would both be about a quarter of the Forest's annual economic impact. The small job creation effect would last for only the four year period in which forest products would be produced. Since the positive effect is so short-lived, there would be no long-term impact on employment in the county.

Cumulative Effects

Social

Adding the effects of past, current and reasonably foreseeable future actions as identified in Appendix C to the effects of this alternative would have positive effects but these are not likely to be significant cumulative effects on the use of resources for the benefit of Siskiyou County nor on the fire-safety of communities.

Economic

Adding the effects of past, current and reasonably foreseeable future actions as identified in Appendix C to the effects of this alternative would have positive effects but these are not likely to be significant cumulative effects on revenue generated, employment or labor income. Private timber harvests in Siskiyou County have amounted to an average value of \$28,600,000 over the 2007 to 2011 period (Dennis 2012). The Forest's forest product sales produced only three percent of this value in the 2010 to 2015 period. Alternative 2 would produce only 0.5 percent of the average private timber sale value, and then only for the sale year. Similarly, the alternative would support only nine percent of the total 480 jobs in the timber products sector within Siskiyou County.

Alternative 3

Direct and Indirect Effects

Social

Under this alternative, treatments that provide revenue to the County would be implemented on about 2,230 acres. This would increase the use of resources of the project area for the benefit of Siskiyou County residents and property owners in the short term. The fire-safe

character of residents, property owners or communities within or adjacent to the project area would be improved on a total of about 11,310 acres in the short term. Of these acres, 2,190 would be in fuel breaks (including 650 adjacent to private property), 4,430 in prescribed underburning, 760 in mastication, 1,690 in thinning without product removal and thinning with removal of forest products on about 2,230 acres (these 2,230 acres are the same ones that would provide revenue and use resources as mentioned above). In the long term, fire safety is expected to increase since dense vegetation would be thinned and the likelihood of high intensity wildfire would decrease, especially adjacent to private property (see the Fire and Fuels Resource Report for additional information). There would be no disproportionately high and adverse human health or environmental effects on American Indians or those below the poverty level.

Economic

Alternative 3 would make available an estimated 2,651,300 cubic feet of forest products, with the same proportion of products as Alternative 2. This amounts to 20 percent less volume of forest products produced than in Alternative 2. Compared to the Forest annual forest product target, Alternative 3 would be 49 percent of the planned 5,400,000 cubic foot volume. The appraised base value of these forest products, subtracting logging and hauling costs, is estimated at \$127,000 (Region 5 Timber Sale Economic Evaluation model).

Although 49 percent of the planned volume, the value amounts to only 16 percent of the projected \$810,000 annual value of forest products sold by the Forest. The magnitude in difference between relative volume and value of forest products is not significantly different than in Alternative 2; each metric has declined about four to five percent.

Direct employment in the timber products sector supported by forest product removals is estimated at 37 jobs with a direct labor income value of \$1,550,900. This employment would be supported for the period of four years which is the estimated period over which forest products would be produced and jobs created. The majority of employment supported is in mill processing (26 jobs) and timber harvesting (eight jobs). Direct employment through this project is estimated at 23 percent of total jobs annually supported in the timber products sector by the Forest, based on the five-year average. Labor income value is the same proportion, about 19 percent of the approximately \$8,114,000 in direct labor income supported by the Forest.

Alternative 3 has an overall positive economic effect. The planned forest product outputs would be half of the Forest's annual target, though five percent less of the relative total than Alternative 2. Value relative to the total value of Forest annual target is similarly less, about a decline of five percent to only 15 percent of the annual total. Employment and labor income are about a fifth of the Forest's annual economic impact, again about five percent less than in Alternative 2. The small job creation effect would last for only the four year period in which forest products would be produced and have no long-term impact on employment in the county.

Cumulative Effects

Social

Adding the effects of past, current and reasonably foreseeable future actions as noted in appendix C to the effects of this alternative would have positive effects but these are not likely to be significant cumulative effects on the use of resources for the benefit of Siskiyou County nor on the fire-safety of communities.

Economic

Adding the effects of past, current and reasonably foreseeable future actions as identified in Appendix C to the effects of this alternative would have positive effects but these are not likely to be significant cumulative effects on revenue generated, employment or labor income. Private timber harvests in Siskiyou County have amounted to an average value of \$28,600,000 over the 2007 to 2011 period (Dennis 2012). The Forest's forest product sales produced only three percent of this value in the 2010 to 2015 period. Alternative 3 would produce only 0.5 percent of the average private timber sale value, and then only for the sale year. This proportion is not significantly different than Alternative 2. Similarly, Alternative 3 would support only eight percent of the total 480 jobs in the timber products sector within Siskiyou County, a decline of one percent from Alternative 2.

3.14.6 Comparison of Alternatives

Social

Table 3-56 provides a comparison of alternatives on social analysis indicators. As noted, the beneficial effects to fire-safety are greater for Alternative 3 than for Alternative 2, and both action alternatives are more beneficial than Alternative 1. Beneficial effects to the use of resources are greater for Alternative 2 than for Alternative 3, and both action alternatives have greater benefits than Alternative 1.

Table 3-56: Comparison of Alternatives on Social Analysis Indicators

Indicator	Measurement	Alternative 1	Alternative 2	Alternative 3
Use of Resources	Acres of product removed	0	2,870	2,230
Fire Safety	Total acres treated (all treatments included)	0	10,600	11,310
Fire Safety	Acres of fuels treated adjacent to private property	0	60	650

Economic

Table 3-57 provides a comparison of alternatives on economic analysis indicators. Beneficial economic effects are greater for both action alternatives than for Alternative 1. Alternative 2 would provide a slightly greater economic benefit in terms of revenue, jobs and direct labor income generated than Alternative 3.

Table 3-57: Comparison of Alternatives on Economic Analysis Indicators

Indicator	Measurement	Alternative 1	Alternative 2	Alternative 3
Revenue based on estimated timber sold	Dollars	0	158,300	127,000
Employment	Number of jobs	0	45	37
Direct labor Income generated	Dollars	0	1,919,300	1,550,900

3.14.7 Compliance with law, regulation, policy, and the Forest Plan

All alternatives comply with relevant laws, regulations, policy and the Forest Plan as noted in the Forest Plan Consistency Checklist, available on [the Project website](#). Compliance with Executive Order 12898 on Environmental Justice and the USDA Civil Rights policy are as disclosed in the social environmental effects sections of this report.

3.15 Climate Change

Increasingly, the relationships between human-caused emissions, climate change, and the role of the forests as carbon sinks (carbon sequesters) are being documented (IPCC 2007, U.S. EPA 2013, USGCRP 2014); it is generally agreed that human activities are now the dominant agents of climate change (USGCRP 2014, Appendix 3, page 736). Scientific understanding of observed temperature changes in the United States has improved; the latest estimates are that average temperatures in the United States are expected to increase by about 4.4 degrees centigrade if current greenhouse gas emissions continue and by about 1.4 degrees centigrade if immediate and rapid greenhouse gas reductions occur (USGCRP 2014, chapter 2, figure 7). Trends in heat waves, drought, and fire risk are increasing in many regions as temperatures and evaporation rates rise (USDA 2011b, USGCRP 2014, Appendix 3, pages 736 and 769-772); these trends have affected and are likely to continue to affect the project area.

Although climate change simulations vary in making future predictions of climate change in regard to projected precipitation, in most observations precipitation events have become more extreme (USGCRP 2014, Appendix 3, page 770, figure 32). Most precipitation in the western United States has been occurring, and is projected to continue to occur, during winter storms. However, if winter temperatures increase in Northern California as they have before the winter of 2016-2017, this may mean that more of the winter precipitation falls as rain and less as snow. Snow accumulations may decrease as was observed in the project area in 2014 and 2015; spring snow melt may occur earlier than in the past. These findings may increase the likelihood of continued drought and risk of wildfire.

Although there is little local scientific information to help predict whether or not storms may increase in size or frequency, since 1964 there have been major channel-altering events about once per decade in the Klamath Mountains (Cover et al. 2010). There is national evidence that storms are more extreme than in the past (USGCRP 2014). If these trends are indicative of what would happen locally, extreme storm events may occur in the project area in the future.

The use of future climate scenarios and ecological models suggests that the impact of climate change on ecosystems in the United States may include increases in ecosystem productivity

in the short term and shifts in the distribution of plants and animals in the long term (Joyce and Birdsey 2000, Anderson and Palik 2011). Although there is no local scientific information to predict what changes will occur in the project area, there is an opportunity with this project for some adaptation to climate change effects on the local level.

Adapting to climate change and its potential impacts poses challenges and opportunities to managing resources. Forests and rangelands are seen as part of the solution to reducing atmospheric carbon dioxide and other greenhouse gases due to their ability to sequester or store carbon (U.S. EPA 2013). Forest ecosystems and the associated wood products industry currently serve as a “carbon sink,” offsetting about 16 percent of carbon dioxide emitted by fossil fuel burning in the United States in 2011 (USGCRP 2014, chapter 7, page 176). Climate change, combined with current societal trends in land use, is projected to reduce this rate of forest carbon uptake (USGCRP 2014, chapter 7, page 179) but forest management practices that increase forested areas (planting or encouraging growth of forests) have the potential to increase carbon sinks (USGCRP, chapter 7, page 181).

Some uncertainty continues to exist in quantifying the impact of project-level emissions on climate. Although down-scaling techniques are in use to assess global climate change impacts at regional levels, there are uncertainties in these approaches especially in applying them to the project level. Projecting climate change impacts at the local level is a resource intensive approach with methodological limitations (USGCRP 2014, Appendix 3, page 761). Local information concerning precipitation and temperature in the vicinity of the project area suggests that national predictions on increasing temperature and erratic precipitation trends may be reflected at the project level (Butz and Safford 2011 and Butz et al. 2015).

Specifically, the following may occur:

- Increases in average temperatures, with earlier snowmelt, may cause fuels to grow more rapidly and also dry more rapidly (predicted by many future climate scenarios), and may lead to an increase in the size and frequency of wildfires with warmer, drier and longer fire seasons as was evident in 2014;
- Thinning of overly dense stands can reduce fuels, especially those larger fuels that are slow to ignite but burn at high intensities which lead to heated soils and damaged soil productivity; and
- From our current state of understanding, climate change may bring about increases in insect and pathogen outbreaks.

Based on regional predictions of a warming climate and increases in disturbances such as wildfire and insect infestations, it is expected that treatments proposed in the action alternatives for this project would benefit forests by reducing the amount and severity of future high intensity fire and promoting resilient and healthy forests. Some adaptation measures such as assisted migration of vegetative and animal species are not proposed due to both difficulty in anticipating climate-related changes at local scales (USGCRP 2014, chapter 28, page 671) and lack of knowledge about the impacts to the species and ecosystem from such migration (Millar et al. 2007).

The contribution of this project to factors that may affect climate change such as greenhouse gas emissions is disclosed in the Air Quality section of this chapter and referenced Air Quality Resource Report. Knowledge about how to effectively manage forests for carbon

sequestration is evolving; active forest management is believed to be an effective method of long-term carbon sequestration (IPCC 2007, USGCRP 2014, and USDA 2011b). Although there are models to calculate carbon storage for forests, using these models for this project does not seem to be cost-efficient due to the small scale of the project in regard to it affecting carbon storage, and the ability of such modeling results to demonstrate a difference between the action and no action alternatives. Thinning with and without forest product removal and additional fuel-reduction treatments would not eliminate wildfire from the project area but can help change fire behavior (as discussed in the Fire and Fuels section of this chapter and Fire and Fuels Resource Report) thereby likely reducing carbon dioxide emissions resulting from wildfire. Short-term negative effects on carbon storage from prescribed burning are balanced by long-term carbon storage negative effects from wildfire. Effects on future global climate change from this project are too small to measure but mitigation and adaptation techniques (USGCRP, chapters 27 and 28) are expected to be beneficial.

3.16 Short-term Uses and Long-term Productivity

NEPA requires consideration of “the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR 1502.16). As declared by Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Short-term uses and their effects are those that occur within the first few years of project implementation as discussed in resource sections of this chapter. Long-term productivity refers to the capability of the land and resources to continue producing goods and services long after the project has been implemented. Under the Multiple-Use Sustained-Yield Act, and the National Forest Management Act, all renewable resources are to be managed in such a way that they are available for future generations. Harvesting trees by thinning, and use of the timber that results from the thinning, can be considered a short-term use of a renewable resource. As a renewable resource, trees can be maintained and continue to grow on the project area if the long-term productivity of the land is maintained. This long-term productivity is maintained through the application of the project design features described in chapter 2 in Table 2-1, especially those applying to the soil, water, and geology resources (Watershed).

The action alternatives (2 and 3) both would provide for the long-term productivity of the project area through removal of biomass and other fuel reduction actions creating a resilient forest where areas can recover from future fire effects naturally.

Harvesting trees through thinning in the action alternatives would reduce stocking levels (trees per acre and stand density index), leading to reductions in density-related mortality including those from some types of insect and disease infestations. The resulting stand conditions would be more sustainable over the long term from the standpoints of vegetative diversity and ecological processes. Treatments in the action alternatives are expected to promote the development of healthier and more resilient stands.

Mastication, in which units primarily consist of brush, re-arranges the fuel bed from standing brush to finer fuels on the surface floor. In comparing pre- versus post- treatments in these units, fire type in treated and maintained areas are anticipated to stay a surface fire with flame lengths less than four feet. Fuel loads of masticated fuel beds for previous projects have not shown to be a concern for undesired fire effects in the event of a wildfire or during prescribed fire for the project area. Both action alternatives would improve the chances of successful direct attack during suppression of a wildfire. The ridgetop and roadside treatments would improve the effectiveness and safety of fighting fires. The action alternatives would improve the defensibility of the communities of Yreka and Hawkinsville against wildfire.

In the action alternatives, hydrologic stabilization of temporary roads on existing roadbeds and the treatment of legacy sediment sites may cause short-term risks to water quality from displaced soils but these risks would be minimized by application of project design features. In the long term, closing temporary roads after use and hydrologic stabilization would avoid impacts of erosion and sedimentation as described in the soils and hydrology sections of this chapter.

The action alternatives would degrade foraging habitat used by northern spotted owl by a small amount in the short term; however, this is offset by reducing the density of vegetation and improving stand health and ecological processes in the long term as described in the wildlife section of this chapter. Long-term beneficial effects would occur as desired tree species and currently mid-sized trees grow.

Alterations in scenery would be slightly noticeable in the short term in all action alternatives but these would be minimized by the application of project design features. In the long term, the scenery mosaic would have a substantially greater likelihood of being perpetuated by action alternatives than with taking no action.

3.17 Unavoidable Adverse Effects

Implementation of either of the action alternatives is not expected to cause any adverse environmental effects that cannot be effectively mitigated or avoided by design features. Unavoidable adverse effects often result from managing the land for one resource at the expense of the use or condition of other resources; this is not the case for the Craggy Project. Some negative effects are short-term and necessary to achieve long-term beneficial effects. Many negative effects can be reduced, mitigated, or avoided by limiting the extent or duration of effects. Applying specific design features from Table 2-1 in chapter 2, and following standards and guidelines from the Forest Plan including implementation of best management practices, further limit the extent, severity, and duration of potential negative effects. Full descriptions of the effects of implementing alternatives can be found in the resource sections of this chapter.

3.18 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. No irreversible commitments of resources are identified for this project.

Irretrievable commitments are those that are lost for a period of time such as the use of renewable resources. The temporary loss will be irretrievable but the action will not be irreversible. Under Alternative 1 the potential for a highly intense and severe wildfire would continue to exist, which could have adverse effects to more than one resource (see chapter 3 resource sections). Under action alternatives, the risk of loss of forest vegetation due to a potential wildfire, and the impact of this loss to resources associated with forest vegetation, would be reduced but not eliminated. Vegetation removed as a byproduct of thinning and fuel reduction treatments would constitute loss of individual trees that are harvested but this would not result in a loss of productivity of entire stands of vegetation. Functionality of forest habitats would continue and conditions are expected to improve ranging from immediately post-project activities for certain resources, and within several decades for others. Effects are in accordance with the goals as described in chapter 1, purpose and need, and as disclosed in chapter 3 resource sections

3.19 Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs “to the fullest extent possible, agencies shall prepare environmental impact statements concurrently with and integrated with other environmental review laws and executive orders.

Clean Water Act

The Clean Water Act, as amended, regulates the dredging and filling of freshwater and coastal wetlands. Section 404 (33 USC 1344) of the Clean Water Act prohibits the discharge of dredged or fill material into waters (including wetlands) of the United States without first obtaining a permit from the U.S. Army Corps of Engineers. Wetlands are regulated in accordance with federal Non-Tidal Wetlands Regulations (Section 40). No dredging or filling is proposed as part of any action alternative considered under this project, and no permits are required. The Craggy Project is in compliance with the Clean Water Act. Temperature is the relevant water quality objective for this project as defined in the North Coast Regional Water Quality Control Board’s Water Quality Control Plan Basin Plan (Streams within the Craggy Project are listed within the 303(d) list for multiple impairments, as it is a tributary of the Middle Klamath River; however, temperature is most relevant to streams within the Craggy Project, as sources for the other pollutants are rare or non-existent. North Coast Water Board, (State Water Resources Control Board, 2012). The Basin Plan is available on the web (see Literature Cited section below). Project-specific best management practices to maintain water quality for those beneficial uses during project implementation are contained in Appendix D. The project-specific best management practices would be used to meet water quality objectives specified in the Basin Plan as discussed in this draft environmental impact statement and the Craggy Fisheries and Hydrology Resource Reports, available on [the Project website](#).

Compliance with the Clean Water Act is regulated by the North Coast Regional Water Quality Control Board through a Waiver of Waste Discharge Requirements for Nonpoint Source Discharges Related to Certain Federal Land Managed Activities on National Forest System Lands (Order No. R1-2015-0021). Compliance with the conditions of the Waiver equals compliance with the Clean Water Act and related total maximum daily loads for each impaired watercourse (North Coast Regional Water Quality Control Board, 2015). The

Forest intends to comply with the 2015 Waiver, which will be fully divulged within the application for coverage under the Waiver, to be submitted immediately following the Record of Decision for the Craggy Project.

The project is also in compliance with the National Forest Management Act of 1976 as implemented by the Forest Plan, particularly to the requirements of the Aquatic Conservation Strategy. Disclosure of compliance with the Aquatic Conservation Strategy is available in Appendix F. More information on compliance with the Klamath National Forest Plan is found in the Forest Plan Consistency Checklist, also on [the Project website](#).

Clean Air Act

The Clean Air Act of 1970, as amended, provides for the protection and enhancement of the Nation's air resources. No exceeding of federal or state ambient air quality standards is expected to result from any action alternative considered in this project, as disclosed in chapter 3 (Section 3.10) and in the Air Quality Report.

Environmental Justice (Executive Order 12898)

Executive Order 12898 relating to environmental justice requires an assessment of whether minorities or low-income populations will be disproportionately affected by any proposed action. As discussed in the social and economic report in chapter 3, Siskiyou County has a disproportionate number of low-income residents and a slightly larger percentage of Native Americans than the State of California. Job creation associated with action alternatives would be beneficial to low-income people who are seeking jobs. The alternatives would have no adverse effects on human health or the environment that are significant, unacceptable, or above generally accepted norms and; therefore, there would be no disproportionate effects on minorities or low income population.

Non-native Invasive Species (Executive Order 13112)

This executive order directs federal agencies to prevent the introduction of invasive species; detect and respond rapidly to and control such species; not authorize, fund, or carry out action that the agency believes are likely to cause or promote the introduction or spread of invasive species unless the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and take all feasible and prudent measures to minimize risk of harm in conjunction with the actions. Project design features minimize the environmental effects of action alternatives, as disclosed in chapter 2, Table 2-1, and meet the requirements of this executive order.

National Historic Preservation Act

Consultation with federally-recognized tribes was initiated early on in the project planning stage in accordance with the Region 5 Programmatic Agreement, National Historic Preservation Act, and other laws and regulations. No concerns were expressed regarding the proposed action. This project is in compliance with Section 106 of the National Historic Preservation Act. Consultation with the State Historic Preservation Office for the State of California is ongoing as discussed in the Heritage Resources section of chapter 3.

Implementation of project design features will protect any heritage resources. Scoping did not reveal any concerns from the public in this regard. No known properties eligible for the

National Register of Historic Places would be affected by action alternatives (see the Heritage Resources section of this chapter).

Wild and Scenic Rivers Act

Because the Wild and Scenic River Corridor of the Klamath River occupies a very small portion of the project area, all on private land at the confluence with Humbug Creek, and that portion is located away from project activities, no wild and scenic river report is included as a part of this analysis.

Action alternatives would not adversely affect the Klamath Wild and Scenic River.

Endangered Species Act

Compliance with the Endangered Species Act is disclosed in the Wildlife and Aquatic Resources sections of this chapter and related resource reports. Consultation with the National Fisheries Marine Service for fisheries and with the U.S. Fish and Wildlife Service for wildlife species is ongoing.

Energy Requirements, Conservation Potential, Depletable Resource Requirements

Consumption of fossil fuels would occur with the action alternatives during logging and hauling trees that have been cut, during mastication and thinning, and during the hydrologic stabilization of temporary roads on existing and new roadbeds. No unusual requirements are included in action alternatives nor do opportunities exist to conserve energy at a large scale. Application of standards and guidelines from the Forest Plan for soils, and project design features identified in chapter 2, Table 2-1, would conserve soil productivity. Supporting information can be found in the Craggy Soils Report, incorporated by reference and available on [the Project website](#). The project is consistent with the Northern Spotted Owl Recovery Plan as disclosed in the Wildlife section of this chapter and the Wildlife Resource Report.

National Forest Management Act

Consistency with the Forest Plan meets the requirements of compliance with the National Forest Management Act. Consistency with the Forest Plan is disclosed throughout this chapter and in the Forest Plan Consistency Checklist available on [the Project website](#).

Prime Farmland, Rangeland, and Forest Land

The project area does not contain any prime farmland or rangeland. Prime forest land does not apply within the National Forest System lands.

Possible Conflicts with Other Land Use Plans

The action alternatives are entirely on National Forest System lands. The action alternatives are not in conflict with planning objectives for Siskiyou County or local Indian tribes as discussed in the Heritage and Social and Economic sections of this chapter and in referenced resource reports.

Incomplete or Unavailable Information

Applicable scientific information is discussed in the resource sections of this chapter and related resource reports. The unavailability of definitive scientific information is discussed in the “Climate Change” section of this chapter. Incomplete or unavailable information will not influence the disclosure of effects on other resources in this project.

CHAPTER 4 CONSULTATION AND COORDINATION

4.1 Preparers and Contributors

The Forest Service consulted the following Federal, State, and local agencies, tribes, other organizations, and individuals during the development of this environmental impact statement:

Interdisciplinary Team Members

Patricia A. Grantham, Forest Supervisor; responsible official for decision; Klamath National Forest

Ted McArthur, Salmon and Scott River District Ranger; responsible for managerial leadership; Klamath National Forest

Andrew Mueller, Team Lead and Forester

Education: Graduated from Michigan State University with a Bachelor of Science in Forestry. Attended graduate school at Virginia Polytechnic and State University from 2009-2010, studying for a Master's of Science in Forestry.

Experience: Seven years' experience with the Forest Service in timber management. Three years as a forester (sale preparation), four years as forestry technician (timber sale preparation).

Angie Bell, Forest Geologist

Education: Graduated from the University of Montana with a Master's of science in Geology. Graduated from Edinboro University of Pennsylvania with a Bachelor of Science in Geology.

Experience: Eight years' experience with the Forest Service. Two years as a geologist and six years as the Forest geologist on the Klamath National Forest.

Margaret Boland, Sociologist

Education: Graduated from the University of Michigan with a Masters of Art in Sociology; graduated from the University of Michigan with a Bachelor of Arts in Sociology.

Experience: Twenty-five years in the Forest Service as a sociologist, planner, environmental coordinator, and line officer. Eight years with Northern California Resource Center as an environmental coordination trainer.

Amaria Crocoll, NEPA Planner and Writer/Editor

Education: Graduated from the State University of New York at Albany with a Bachelor of Arts in English. Geographic information systems certified from Shasta College.

Experience: Nine years' experience with the US Forest Service. Four years as an archaeological technician, four years as a forestry technician for timber stand improvement. One year experience as a NEPA planner contracted to the Forest Service.

Danika Carlson, Botanist and NEPA Planner

Education: Graduated from Southern Oregon University with Bachelor of Science in Environmental Studies and a botany certificate.

Experience: Seven years of experience with the Forest Service in botany.

Jason Coats, Archeologist

Education: Graduated from the University of Maine with dual Bachelor of Arts in Anthropology and English.

Experience: Ten years' experience with the Forest Service Heritage Resources program and the private sector. Two years as an Archeological Technician (Forest Service and private), and eight years as a Forest Service Archeologist.

Sam Cuenca, Wildlife Biologist

Education: Graduated from Humboldt State University with Bachelor of Science in Wildlife Management and a minor in Fisheries.

Experience: Twenty-seven years of experience with the Forest Service in wildlife management. Specialty in threatened, endangered, and sensitive species management. Regional coordinator for Naturewatch outreach education program. Regional liaison for the California Deer Association.

Karl Dietzler, Landscape Architect

Education: Graduated from University of Oregon with a Master's of Landscape Architecture and a Master's of Science in Historic Preservation. Graduated from the University of Massachusetts, Amherst with a Bachelor's of Science in Natural Resources.

Experience: Six years with the U.S. Forest Service; one as a Landscape Architect, and five in Recreation and Special Uses.

Chris Ester, Hydrologist

Education: Graduated from the University of Wisconsin – Stevens Point with a Bachelor of Science in Hydrology.

Experience: Going on two years with the Forest Service on the Klamath as district Hydrologist. Previously, three years of experience in various hydrology technician positions and six months as a water supply engineer for an NGO in Kenya.

Marissa Jones, Forester

Education: Graduated from Humboldt State University with a Bachelor of Science in Wildland Fire Management. Graduated from University of California, Los Angeles with a Bachelor of Art in Psychology

Experience: Fifteen years of experience with the US Forest Service. Six years as a forester, two years in timber sale preparation, and seven years in fuels, fire and aviation management

Clint Isbell, Fuels Planner;

Education: Graduated from University of Idaho with a Master's of Science in Fire Ecology. Graduated from California Polytechnic State University with a Bachelor of Science in Natural Resources

Experience: Seventeen years' experience with the US Forest Service in fire and aviation management, with ten of those years as a fire ecologist.

William Tripp, Soil Scientist

Education: Graduated from the University of Wyoming with a Bachelors in Agroecology with a minor in Soils. Graduated from Sheridan Wyoming Community College with an Associates in Agriculture Science.

Experience: Nine months with the Forest Service (2016 to the present). Five and a half years in Natural Resources Conservation Service (NRCS) performing soil surveys in Stephenville, TX; three months performing soil surveys in Lyman, WY.

Carl Varak, District Timber Management Officer/Silviculturist;

Education: Graduated from Michigan Technological University with a Bachelor of Science in Forest Management degree.

Experience: Three and a half years' experience as a Forester with private industry. Thirty-six years with the US Forest Service on the Klamath National Forest: timber sale preparation-forester (1980-85); reforestation culturist (1985-2007); silviculturist (certified 1989-present); district timber management officer (2007-present)

Reviewers

Lauren McChesney, Forest Environmental Coordinator; Klamath National Forest

Consulted Federal, State, and Local Agencies and Governments

United States Fish and Wildlife Service

United States Environmental Protection Agency

United States Bureau of Land Management

National Oceanic and Atmospheric Administration

National Marine Fisheries Service

Northern Coast Regional Water Quality Control Board

California State Historic Preservation Office

California Department of Forestry and Fire Protection (CALFIRE)

Consulted Recognized Tribes

Karuk Tribe of California

Quartz Valley Indian Reservation

Others: Non-recognized Tribes, Organizations, and Individuals

Shasta Indian Nation

Shasta Nation, Inc.

George Jennings, Yreka Area Fire Safe Council

Steve Baker, city manager, Yreka City

Mayor and City Council members, Yreka City Council
George Sexton, Klamath Siskiyou Wildlands Center

4.2 Distribution of the Environmental Impact Statement

This environmental impact statement has been distributed to individuals who specifically requested a copy of the document. In addition, notice of availability of the document, or copies if requested, have been sent to the following Federal agencies, federally recognized tribes, State and local governments, and organizations representing a wide range of views.

Federal, State, and Local Agencies

Advisory Council on Historic Preservation
California Department of Fish and Wildlife
Federal Aviation Administration
National Marine Fisheries Service, Arcata Office
North Coast Region Water Quality Control Board
Siskiyou County Board of Supervisors
Siskiyou County Fish and Game Commission
State Historic Preservation Officer
U.S. Army Engineer Division, South Pacific
U.S. Coast Guard
U.S. Navy
USDA APHIS PPD/EAD
USDA National Agriculture Library
USDA National Resources Conservation Service
U.S. Environmental Protection Agency
USDI Fish and Wildlife Service
Yreka Office Environmental Protection Agency, Region 9

Federally Recognized Tribes

Karuk Tribe of California
Quartz Valley Indian Reservation

Organizations, Individuals and Other Tribes

Kimberly Baker, Klamath Forest Alliance and Environmental Protection Information Center
Thomas Wheeler, Environmental Protection Information Center
Gerard van Hees, American Forest Resources Council

George Sexton, Klamath Siskiyou Wildlands Center

Shasta Indian Nation

Shasta Nation, Inc.

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4.3 Acronyms, Glossary, Literature Cited and Index

4.3.1 Acronyms

ACSaquatic conservation strategy
BMP	.....best management practice
CALFIRE	.....California Department of Forestry and Fire Protection
CEQ	.....Council on Environmental Quality
CFR	.....Code of Federal Regulations
CWE	.....cumulative watershed effects
DEIS	.....draft environmental impact statement
EPA	.....U.S. Environmental Protection Agency
ERA	.....equivalent roaded area
ESA	.....Endangered Species Act
FSH	.....Forest Service Handbook
FSM	.....Forest Service Manual
GEO	.....geology model (mass-wasting)
GIS	.....geographic information system
IPCC	.....Intergovernmental Panel on Climate Change
IMPROVE	.....Interagency Monitoring of Protected Visual Environments
LOP	.....Limited Operating Period
MA	.....Management Area
MIS	.....Management Indicator Species
MVUM	.....Motor Vehicle Use Map
NEPA	.....National Environmental Policy Act
NFMA	.....National Forest Management Act
NMFS	.....National Marine Fisheries Service

NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NRCS	National Resources Conservation Service
NWFP	Northwest Forest Plan
NOS	Normal Operating Season
NSO	Northern Spotted Owl
S&G.....	Standard and Guideline
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USGCRP.....	United States Global Change Research Program
USFS	United States Forest Service
USFWS.....	United States Fish and Wildlife Service
USLE	universal soil loss equation
VQO	Visual Quality Objective
WUI	Wildland Urban Interface

4.3.2 Glossary

Anadromous Fish: Species of fish that are born in freshwater, move to the ocean to mature, and return to freshwater to reproduce

Aquatic: Living or growing in water

Aquatic Conservation Strategy: A strategy “developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands”

Aquatic Conservation Strategy Objectives: Objectives that “define the context for the agency review and implementation of management activities. Complying with the Aquatic Conservation Strategy objectives means that an agency must manage the riparian dependent resources to maintain the existing condition or implement actions to restore conditions. The baseline from which to assess maintaining or restoring the condition is developed through a watershed analysis. Improvement relates to restoring biological and physical processes within their ranges of natural variability.”

Basal Area: The term used in forest management that defines the area of a given section of land that is occupied by the cross-section of tree trunks and stems at their base

Beneficial Uses: “Beneficial uses” of the waters of the state that may be protected against water quality degradation include, but are not necessarily limited to, domestic, municipal, agricultural, and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves (from Section 13050(f) of California’s Porter-Cologne Water Quality Control Act)

Best Management Practices: Measures certified by the California State Water Quality Control Board and approved by the U.S. Environmental Protection Agency as effective means of reducing water quality impacts from non-point sources of pollution

Canopy: Tree crowns in a stand

Coarse Woody Debris: Woody material at least 20-inches in diameter from whatever source that is dead and lying on the forest floor. Term used for terrestrial species habitat. (See Large Woody Debris for aquatic species habitat)

Commercial Thinning: any type of thinning producing merchantable material at least equal to the value of the direct costs of harvesting

Compacted Soils: Soils with reduced porosity

Critical Habitat: Defined in the Endangered Species Act as (1) the specific areas within the geographical area occupied by the species, at the time it is federally listed, on which are found those physical or biological features essential to the conservation of the species, and which may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species at the time it is listed, when it is determined by the Secretary of the Interior that such areas are essential for the conservation of the species.

Cubic Foot: A unit of volume that measures one foot by one foot by one foot (30.48 by 30.48 by 30.48 centimeters).

Cumulative Effects: Those effects resulting from incremental effects of actions, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions.

Cumulative Watershed Effects Model: A model for Cumulative Watershed Effects with three components: Equivalent Roaded Area (ERA), sediment delivery from surface erosion (USLE), and sediment delivery from mass wasting (GEO). The model quantifies disturbances and land sensitivity at the 7th field watershed scale and can calculate them at larger scales. The estimated results fall on a continuum. As disturbances increase over time and space, at some point the risk of initiating or contributing to existing adverse cumulative watershed impacts becomes a cause for concern. Concern thresholds have been identified for each component based on field observations in the Forest.

Direct Attack: Any treatment applied directly to burning fuel such as wetting, smothering, or chemically quenching the fire or physically separating the burning from unburned fuel.

Direct Effects: Those effects occurring at the same time and place as the initial cause or action.

Dispersal: The relatively permanent movement of individual animals from one location to another. Usually dispersal is the movement of young animals from where they were born to a site where they eventually settle to breed.

Dispersed Recreation Site: Where few facilities or developments are provided; those provided are for access and protection of the environment more than comfort or convenience of people.

Distance Zones (for scenery)

Foreground: The detailed landscape found within 0 to ¼ and ½ mile from the observer.

Middleground: The landscape located between ¼ and ½ miles to 3-5 miles from the observer.

Background: The distant landscape located between 3-5 miles and infinity.

Early Seral: The biotic community that develops immediately following the removal (from harvest or disturbance such as wildfire, insect or disease) of vegetation in an area.

Ecosystem: A dynamic community of biological organisms, including humans, and the physical environment with which they interact

Effects: Impacts; physical, biological, economic, and social results (or expected results) from implementing an activity

Endangered Species: Any species that is in danger of extinction throughout all or a significant portion of its range

Environmental Justice: Executive Order 12898 requires an assessment of whether minorities or low-income populations would be disproportionately affected by proposed actions

Equivalent Roaded Area (ERA): An index of average watershed disturbance expressed in road equivalent acres relative to a “threshold of concern” assigned for the watershed.

Erosion: A general term for movement of soil particles on the surface of the land initiated by rainfall and running water. This includes surface erosion and channel erosion, as opposed to landsliding

Evapotranspiration: A sum of precipitation that is lost to the atmosphere through transpiration by the stomata of plants as well as evaporation from plant and ground surfaces

Fire Behavior: The manner in which a fire reacts to fuels, weather, and topography. This may be measured using a range of flame lengths and fire's effects upon vegetation type and size

Fire Return Interval: Number of years between two successive fire events in a given area

Fire Risk: The statistical probability of a fire start occurring over a ten-year period for a given thousand-acre area

Fire Suppression: All work and activities associated with extinguishing a fire

Forest Health: The perceived condition of a forest derived from concerns about such factors as its age, structure, composition, function, vigor, presence of unusual levels of insects or disease, and resilience to disturbance

Forest Plan: The Klamath National Forest Land and Resource Management Plan, approved in 1995. The Forest Plan provides land allocations, Standards and Guidelines, and direction for management of the Klamath National Forest

Fuel Loading: The quantity of fuel per acre.

Fuel Treatment: The process of removing or modifying natural or human created fuels to reduce fire hazard and achieve other resource objectives

Fuels: Anything within the forest that will burn; usually live and dead woody vegetation

Ground-based Equipment: Equipment that runs on the ground, like tractors, rubber tired skidders, and masticators

Ground Fuels: Loose combustible material on the soil surface, consisting of fallen leaves, twigs, bark, and small branches, as well as grasses, small plants, seedlings trees, dead branches, and logs

Hydrologic: Dealing with the movement and properties of liquid water in environmental systems. Includes the circulation patterns of water in the biosphere from condensation and precipitation to movement both on and under the ground surface to evaporation back into the atmosphere

Impacts: Physical, biological, economic, and social results (or expected results) from implementing an activity

Incorporation by Reference: A technique used to cut down on the bulk in environmental documents without impeding agency and public review of the action. The material included as part of the document must be cited in the document and its content briefly described

Indirect Effects: Those effects occurring later in time or that are spatially removed from the activity

Inference Point: The midpoint of a zone where disturbances become great enough to cause concern about initiating or contributing to adverse cumulative watershed effects

Infiltration (soil): The movement of water through the soil surface into the soil

Interdisciplinary: The utilization of individuals representing two or more areas of knowledge and skills focusing on the same subject

Irretrievable: An irretrievable commitment of resources entails a loss of production, harvest, or use of natural resources. Such decisions are reversible, but the production opportunities foregone are irretrievable (50 Federal Register 26082)

Irreversible: An irreversible commitment of resources entails a loss of future options. This applies primarily to the effects of use of non-renewable resources such as minerals or heritage resources, or to those factors, such as soil productivity, that are renewable only over a long period of time (50 Federal Register 26082)

Issue: Point of discussion, debate, or dispute about the environmental effects of the proposed action

Land Allocation: The assignment in the Forest Plan of a management emphasis to particular land areas with the purpose of achieving goals and objectives

Large Woody Debris: Downed wood that is 40 cubic feet or larger to be left in Riparian Reserves for recruitment into 3rd to 5th order streams.

Late-successional characteristics: Characteristics of a stand of trees indicative of maturity, including mature and over-mature trees in the overstory; multi-layered canopy with trees of several age classes; and standing dead trees and down material

Late-successional habitat: Older forested stands with moderate to high canopy closure; often containing a multilayered, multispecies canopy dominated by large overstory trees; large trees with broken tops or other indications of old and decaying wood; numerous large snags; and moderate to heavy accumulations of large logs on the ground

Late-successional reserves (LSR): Large blocks of habitat that are distributed across the range of the northern spotted owl and spaced closely enough to facilitate dispersal of owls. Late-successional reserves are managed to provide habitat for late successional and “old growth” species

Legacy Sediment Site: Sites or sources with existing discharge or potential discharge into water courses that are the result of human activity from the past and can reasonably and feasibly be remedied (Water Board 2010).

Management Area (MA): A distinct geographical area with specified objectives and prescriptions

Management Direction: A statement of multiple use and other goals and objectives, along with the associated management prescriptions and Standards and Guidelines to direct resource management

Masticator: Equipment that grinds or chews up vegetative material

Monitoring: Process of collecting information to evaluate if objective and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned

National Environmental Policy Act (NEPA): The act that governs how federal agencies assess impacts of management actions on public lands. The process is interdisciplinary and requires consideration of the environmental effects of alternatives and disclosure of those effects

National Forest Transportation System Road: A classified Forest road under the jurisdiction of the Forest Service. The term “National Forest System Roads” is synonymous with the term “forest development roads” as used in 23 U.S.C. 205

Non-commercial Thinning: thinning that does not produce merchantable material

Noxious Weed: Any plant so designated by the Weed Control Regulations and identified on a regional district noxious weed control list. They are generally non-native and resistant to control efforts

Overstory: The portion of trees in a forest which forms the uppermost layer of foliage

Peak Flow: The greatest stream or river flow occurring in a year from a single storm event

Phreatic: The zone of saturation, or the ground water aquifer, where all pores between soil particles are completely saturated.

Project Design Feature: elements of the project that are applied in treatment areas. These features are developed based on Forest Plan direction and site specific evaluations in order to reduce or avoid negative environmental impacts of the proposed action.

Quadratic Mean Diameter: the measure of average tree diameter conventionally used in forestry.

Recreation Opportunity Spectrum Classes in Project Area:

Rural: An area characterized by a substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities are often provided for special activities. Moderate densities are provided far away from developed sites. Facilities for intensified motorized use and parking are available.

Roaded Natural: An area characterized by predominantly natural-appearing environments with moderate evidences of the sights and sounds of man. Such evidences usually harmonize with the natural environment. Interaction between users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment.

Record of Decision: A document separate from but associated with an environmental impact statement that states the management decision and provides the rationale for that decision

Residual: The trees remaining after harvesting; also known as the crop trees

Resilience: An ecosystem's ability to maintain structure and patterns of behavior in the face of disturbance

Riparian Area: In general, characterized by being situated on the bank of a river or other body of water; in ecology, the term is applied both to species that live near streams and to the area adjacent to streams where vegetation and microclimate are influenced by the presence of the stream

Riparian Reserves: A land allocation in the Forest Plan that includes an aquatic ecosystem and the adjacent upland areas directly affecting it. It also includes unstable and potentially unstable lands that are not associated with aquatic areas. Specific Standards and Guidelines provide direction for these areas as outlined in Management Area 10 of the Forest Plan

Risk: The chance of loss

Risk Ratio (for cumulative watershed effects model): Amount of the disturbance in the watershed relative to the hydrologic or sediment inference point

Road: A motor vehicle travel way over 50 inches wide, unless classified and managed as a trail. A road may be classified (a National Forest Transportation System road) or temporary (36 CFR 212.1)

Silviculture: The art and science of growing and tending forest vegetation. It includes controlling the establishment, composition, and growth of forests for specific management goals.

Silviculture Prescription: A site-specific operational plan that described the forest management objectives for an area. It prescribes the method for harvesting the existing forest stand, and a series of silviculture treatments that will be carried out to establish a free growing stand in a manner that accommodates other resource values as identified.

Stand Density Index: A relative measure of the amount of stocking on a forest area. Based on the number of trees per unit area and the diameter at breast height of the average sized tree within the stand.

Temporary Roads: Roads authorized by contract, permit, lease, other written authorization, or emergency operation, not intended to be a part of the forest transportation system and not necessary for long-term resource management (36 CFR 212.1). For purposes of this project, temporary roads are assumed to have a ten to 15-foot-wide driving surface, with an average driving surface width of 12 feet and a 15 to 30-foot-wide road prism width, depending on steepness of slope.

Tethered Harvesting Equipment: Ground-based equipment designed for steep slope operations that operates anchored by a cable to increase traction and reduce wheel or track slippage.

Road Maintenance: The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objective.

Scoping: The process used to identify the scope of issues to be addressed and to determine the relevant issues related to a proposed action.

Sediment: Soil particles in water. Suspended sediment consists of small soil particles carried along by the water's turbulent flow.

Silviculture: The art and science of growing and tending forest vegetation. It includes controlling the establishment, composition, and growth of forests for specific management goals

Silviculture Prescription: A site-specific operational plan that describes the forest management objectives for an area. It prescribes the method for harvesting the existing forest stand, and a series of silviculture treatments that will be carried out to establish a free growing stand in a manner that accommodates other resource values as identified

Skyline Yarding System: Moving logs from the stump to the landing either partially or fully suspended by a cable

Snag: A standing dead tree

Social Analysis: Analysis that uses social science information to determine how proposed actions would affect humans

Soil Porosity: State of having pores or holes in the soil that hold air or water; permeability

Soil Productivity: The capability of a soil to produce a specific crop such as fiber, forage, etc., under defined levels of management

Stand: A community of trees or other vegetation uniform in composition, constitution, age, spatial arrangement, or condition to be distinguishable from adjacent communities

Stand Density Index: A relative measure of the amount of stocking on a forest area. Often described in terms of stems per acre

Standard and Guideline: A principle requiring a specific level of attainment, a rule to measure against

Stocking: The degree to which trees occupy the land, measured by BA and/or number of trees by size and spacing, compared with a stocking standard; that is, the BA and/or number of trees required to fully utilize the land's growth potential. Where tree growth is inhibited due to competition from too many trees, the site is said to be overstocked

Stocking Control: See thinning

Suppression Forces: Resources used to fight a fire, consisting of firefighters with hand tools at a minimum; may also include fire engines and bulldozers, helicopters and tanker planes

Suppressed Trees: Smaller trees in the lower canopy layer

Thinning: Removing trees from a stand to redistribute the growth potential or to benefit the quality of the residual stand

Threatened Species: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range

Torching: Ignition and subsequent flare-up of a fire, usually burning from the bottom to the top of a tree or small group of trees

Tree Crown: Leafy portion

Turbidity: Deposition of substrate material suspended in water

Understory: Vegetation (trees or shrubs) growing under the canopy formed by taller trees.

Vadose Flows: Soil water movement within the first few feet of the surface that is not connected with groundwater. It is controlled by different sources than groundwater

Vertical Fuels: Standing vegetation, either live or dead

Visual Quality Objectives:

Retention: Management activities are *not visually evident*, and may only repeat form, line, color, and texture, which are frequently found in the landscape. Changes in their qualities of size, amount, intensity, direction, pattern, etc., should not be evident.

Partial Retention: Management activities remain *visually subordinate* to the characteristic landscape, and may repeat form, line, color, or texture common in the landscape.

Modification: Vegetation and Landform management activities *may visually dominate* the original characteristic landscape; however, they must *borrow from the naturally-established form, line, color, or texture at a level and scale that the visual appearance of the activity mimics those natural features occurring within the surrounding area.*

Maximum Modification: Vegetation and Landform management activities *may dominate* the characteristic landscape; however, *when viewed in the background zone (three to five miles), the visual appearance must mimic those natural features within the surrounding area or character type.* When viewed in *foreground or middle ground*, the activity *may not appear to completely borrow from the naturally-established form, line, color, or texture.*

Watershed: The entire land area that drains to a specific point

5th field watershed: A watershed that ranges from about 40,000 to 250,000 acres in size

6th field watershed: A watershed that ranges from about 10,000 to 40,000 acres in size

7th field watershed: A watershed or drainage that ranges from about 2,500 to 10,000 acres in size

Watershed Analysis: Watershed analysis is a systematic procedure for characterizing watershed and ecological processes to meet specific management and social objectives

Wet Weather Operation Standards: Specific information used to help determine when activities are at risk of not meeting best management practices. The guidelines are used to determine if conditions are favorable for wet weather or winter operations, and to provide guidance as to when conditions warrant suspension of operations, when operations may begin or resume, or when and what remedy may be appropriate.

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APPENDIX A: TREATMENT PRESCRIPTIONS BY UNIT

Table A-1: Alternative 2 Treatment Prescriptions

Unit Number	Type of Treatment	Primary Treatment	Removal Method	Follow up Treatment	Acres
133-89G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	14
134-2S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	42
134-21S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	30
134-23P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	119
134-27S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	10
134-28S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	9
134-29P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	10
134-29S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	5
134-31P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	9
134-32G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	11
134-32P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	10
134-32S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	16
134-33G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	11
134-33S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	42
134-34G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	34
134-34S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	27
134-36S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	32
134-38S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	20
134-39S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	59
134-40G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	16
134-41G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	24
134-41S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	18
134-42G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	12

Unit Number	Type of Treatment	Primary Treatment	Removal Method	Follow up Treatment	Acres
134-42S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	7
134-44G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	20
134-44S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	18
134-47S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	19
134-55E	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Endline	Underburn	5
134-55G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	24
134-58G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	12
134-58S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	6
134-59G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	121
134-70E	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Endline	Manual Thin Trees <10", Scatter or Pile and Burn	13
134-70G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	7
134-70P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	78
134-83G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	13
134-83S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	68
134-107S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	80
134-131P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	22
134-240G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	92
134-240P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	68
134-242G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	59
134-242S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	15
134-244P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	20
134-244S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	8
134-245G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	14
134-246P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	70
134-247G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	29

Unit Number	Type of Treatment	Primary Treatment	Removal Method	Follow up Treatment	Acres
134-247S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	7
134-248E	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Endline	Underburn	1
134-248G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	77
134-248S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	55
134-249G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	27
134-250G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	57
134-250P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	20
134-251P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	37
134-299G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	13
134-299S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	24
136-2G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	45
136-18G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	79
136-21G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	54
136-22G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	103
136-24G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	44
136-25G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	39
136-26S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	30
136-47G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	11
136-57G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	144
136-61P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	57
136-145G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	59
136-146G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	37
136-147G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	105
136-302P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	44
136-400M	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	19

Unit Number	Type of Treatment	Primary Treatment	Removal Method	Follow up Treatment	Acres
136-401M	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	31
136-402M	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	13
136-917M	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	43
136-926P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	75
137-5G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	32
137-5S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	46
137-6S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	43
137-8S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	33
137-Mast	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	139
138-1G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	49
138-3S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	12
138-11G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	33
138-11S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	20
138-12G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	28
138-13S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	41
138-23G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	31
138-23S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	14
138-46E	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Endline	Underburn	19
138-53P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	31
138-53S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	23
138-54S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	20
138-56P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	274
138-56S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	37
138-70P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	99
138-71S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	51

Unit Number	Type of Treatment	Primary Treatment	Removal Method	Follow up Treatment	Acres
138-74M	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	33
138-91G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	35
138-91S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	9
138-102P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Manual Thin Trees <10", Scatter or Pile and Burn	225
138-151G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	22
138-155S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	13
138-501G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	86
138-532G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	10
138-Mast-1	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	80
138-Mast-2	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	39
138-Mast-3	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	26
544-17S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	19
544-19S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	46
544-20E	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Endline	Underburn	26
544-222S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	5
544-Mast	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	479
FBP1	Fuel Break-Adjacent to Private Land	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	63
FBR1	Fuel Break-Roadside	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	34
FBR2	Fuel Break-Roadside	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	207
FBR3	Fuel Break-Roadside	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	203
FBR4	Fuel Break-Roadside	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	262
FBR5	Fuel Break-Roadside	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	71
FBS1	Fuel Break-Ridge	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	136
FBS2	Fuel Break-Ridge	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	195
FBS3	Fuel Break-Ridge	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	157

Unit Number	Type of Treatment	Primary Treatment	Removal Method	Follow up Treatment	Acres
FBS5	Fuel Break-Ridge	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	71
UB1	Prescribed Fire Underburn	Low Intensity Prescribed Fire	N/A	Underburn	2,249
UB2	Prescribed Fire Underburn	Low Intensity Prescribed Fire	N/A	Underburn	901
UB3	Prescribed Fire Underburn	Low Intensity Prescribed Fire	N/A	Underburn	210
UB4	Prescribed Fire Underburn	Low Intensity Prescribed Fire	N/A	Underburn	667
UB5	Prescribed Fire Underburn	Low Intensity Prescribed Fire	N/A	Underburn	137

Table A-2: Alternative 3 Treatment Prescriptions

Unit Number	Type of Treatment	Primary Treatment	Removal Method	Follow-up Treatment	Acres
133-89G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	14
134-2S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	42
134-21S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	30
134-23P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	110
134-27S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	10
134-28S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	7
134-29G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	16
134-29P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	19
134-31G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	9
134-32G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	11
134-32P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	19
134-32S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	16
134-33G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	11
134-33S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	52
134-34G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	50

Unit Number	Type of Treatment	Primary Treatment	Removal Method	Follow-up Treatment	Acres
134-34S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	27
134-36S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	32
134-38S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	14
134-39G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	7
134-39S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	54
134-40G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	16
134-41G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	24
134-41S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	18
134-42G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	12
134-42S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	7
134-44G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	20
134-44S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	18
134-47S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	19
134-55E	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Endline	Underburn	4
134-55G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	28
134-58G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	12
134-58S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	6
134-59G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	97
134-70E	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Endline	Manual Thin Trees <10", Scatter or Pile and Burn	13
134-70G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	7
134-70P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	78
134-83G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	13

Unit Number	Type of Treatment	Primary Treatment	Removal Method	Follow-up Treatment	Acres
134-83S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	68
134-107S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	80
134-131P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	22
134-240G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	12
134-240P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	145
134-242G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	33
134-242P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	26
134-242S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	15
134-244P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	20
134-244S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	8
134-245G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	12
134-246P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	68
134-247G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	29
134-247S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	7
134-248E	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Endline	Underburn	1
134-248G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	77
134-248S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	55
134-249G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	27
134-250G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	57
134-250P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	20
134-251P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	37
134-299G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	13

Unit Number	Type of Treatment	Primary Treatment	Removal Method	Follow-up Treatment	Acres
134-299S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	24
136-2P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	45
136-18G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	63
136-21G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	30
136-21P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	24
136-22G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	103
136-24G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	38
136-25P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	38
136-26G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	4
136-26P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	29
136-47G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	14
136-57G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	135
136-61P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	57
136-145G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	9
136-146G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	8
136-147G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	41
136-302P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	44
136-400M	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	19
136-401M	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	31
136-402M	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	13
136-917M	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	43
136-926P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	75
137-5S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	28
137-6S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	40

Unit Number	Type of Treatment	Primary Treatment	Removal Method	Follow-up Treatment	Acres
137-8S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	33
137-Mast	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	140
138-1G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	45
138-3S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	12
138-11G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	33
138-11S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	20
138-12G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	7
138-13S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	41
138-23P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	45
138-46E	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Endline	Underburn	19
138-53P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	73
138-53S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	23
138-54S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	20
138-56P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	289
138-56S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	37
138-70P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	99
138-71S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	38
138-74M	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	33
138-91S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	16
138-102P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	225
138-151G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	22

Unit Number	Type of Treatment	Primary Treatment	Removal Method	Follow-up Treatment	Acres
138-155S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	13
138-501P	Thinning w/o Removal	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	86
138-532G	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Ground Based Equipment	Underburn	10
138-Mast-1	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	80
138-Mast-4	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	24
544-17S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Manual Thin Trees <10", Scatter or Pile and Burn	19
544-19S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	46
544-20E	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Endline	Underburn	26
544-222S	Thinning w/ Removal	Thin from Below, Remove Cut Trees	Skyline or Tethered Equipment	Underburn	5
544-Mast	Mastication	Masticate Brush, Thin Trees <10 in	N/A	Masticate	382
FBP1	Fuel Break-Adjacent to Private Land	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	295
FBP2	Fuel Break-Adjacent to Private Land	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	115
FBP3	Fuel Break-Adjacent to Private Land	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	170
FBP4	Fuel Break-Adjacent to Private Land	Manual Thin Brush and Trees <10 in	N/A	Scatter or Manual Pile & Burn Piles	72
FBR1	Fuel Break-Roadside	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	33
FBR2	Fuel Break-Roadside	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	204
FBR3	Fuel Break-Roadside	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	203
FBR4	Fuel Break-Roadside	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	303
FBR5	Fuel Break-Roadside	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	71
FBS1	Fuel Break-Ridge	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	197
FBS2	Fuel Break-Ridge	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	166
FBS3	Fuel Break-Ridge	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	190
FBS4	Fuel Break-Ridge	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	104
FBS5	Fuel Break-Ridge	Manual Thin Brush and Trees <10 in	N/A	Manual Pile & Burn Piles	71

Unit Number	Type of Treatment	Primary Treatment	Removal Method	Follow-up Treatment	Acres
UB1	Prescribed Fire Underburn	Low Intensity Prescribed Fire	N/A	Underburn	2,279
UB2	Prescribed Fire Underburn	Low Intensity Prescribed Fire	N/A	Underburn	901
UB3	Prescribed Fire Underburn	Low Intensity Prescribed Fire	N/A	Underburn	215
UB4	Prescribed Fire Underburn	Low Intensity Prescribed Fire	N/A	Underburn	897
UB5	Prescribed Fire Underburn	Low Intensity Prescribed Fire	N/A	Underburn	137

APPENDIX B: VICINITY AND TREATMENT MAPS

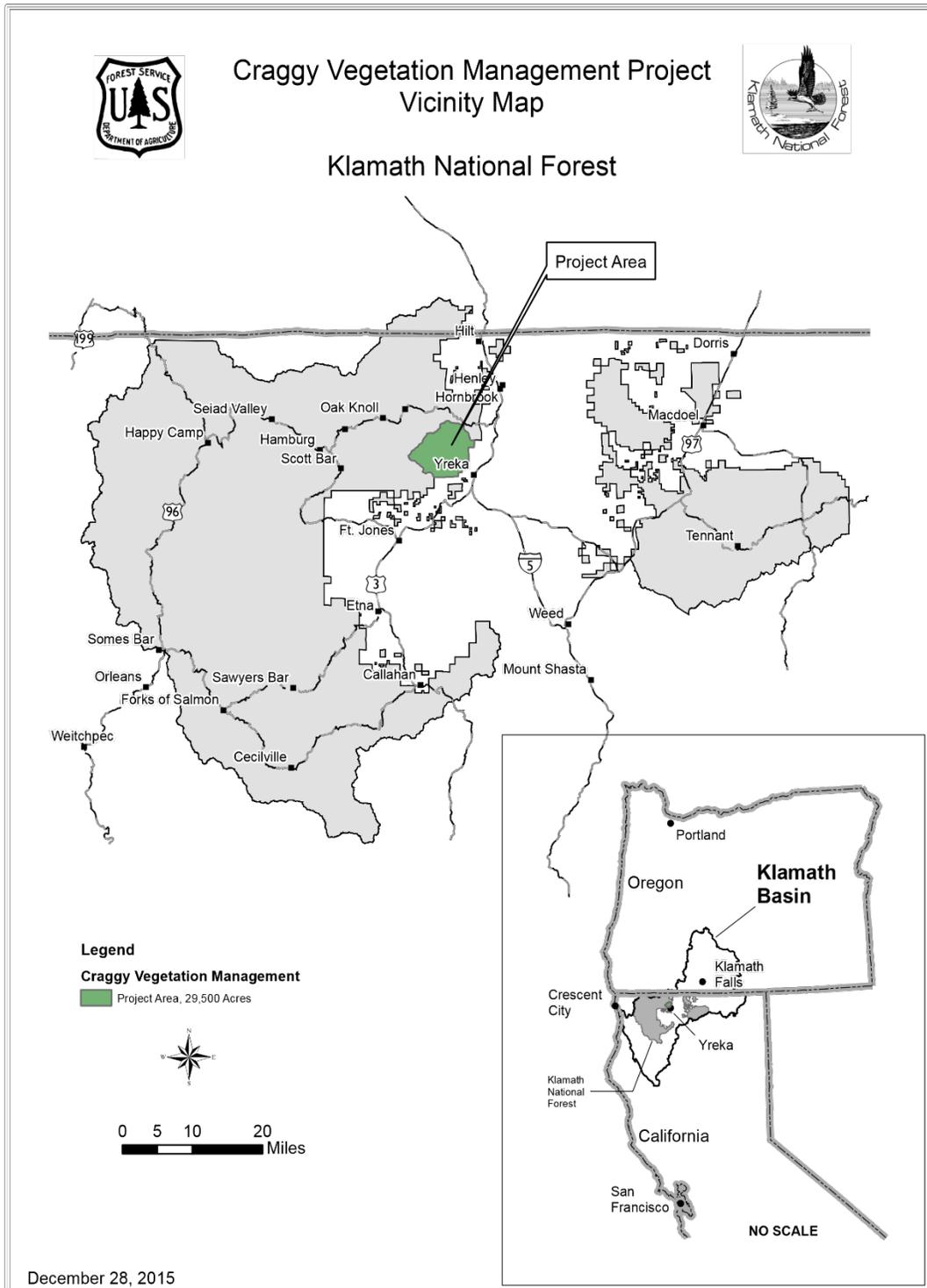


Figure B-1: Vicinity Map

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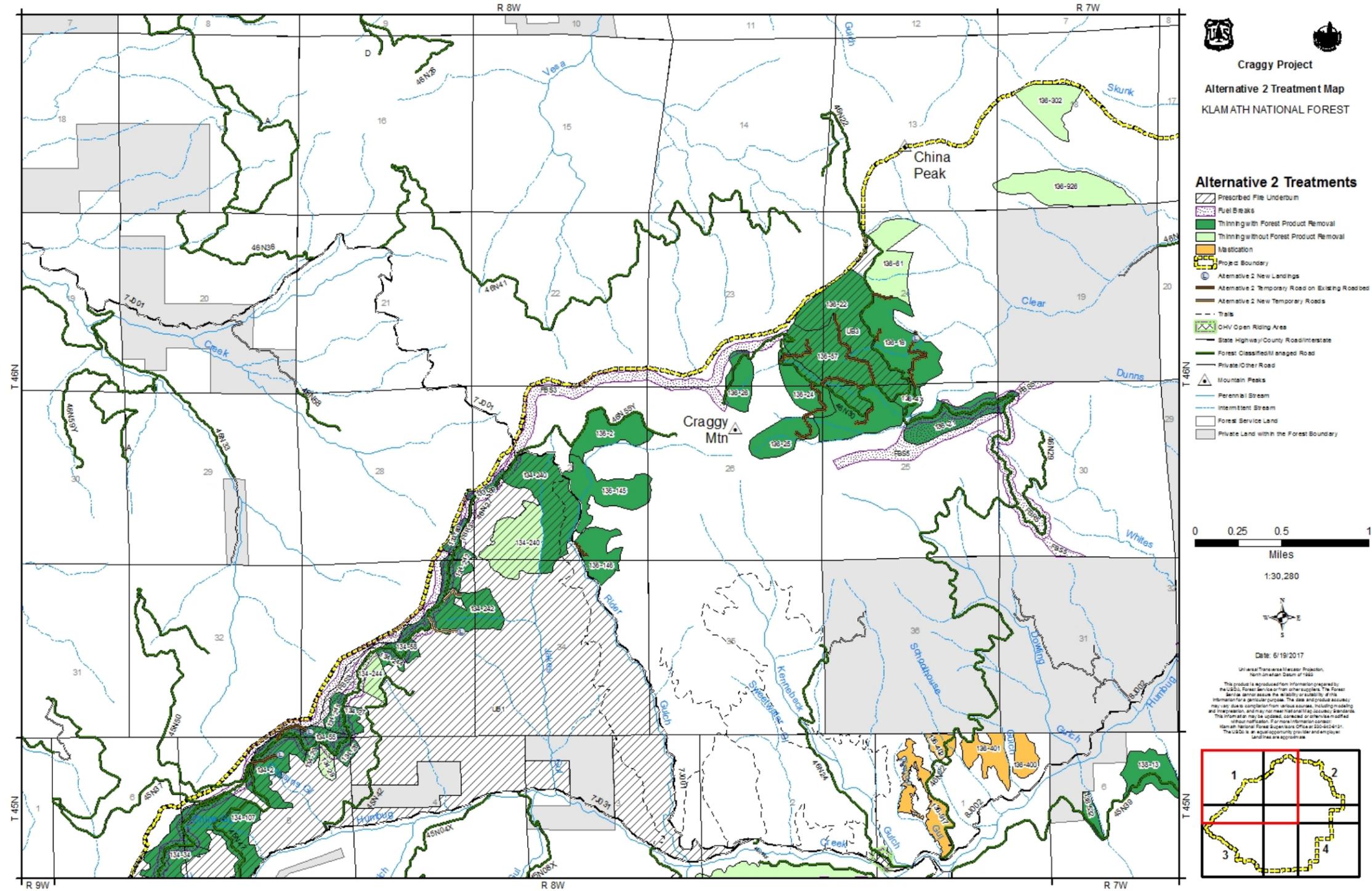


Figure B-2: Alternative 2 Treatment Map Page 1 of 4

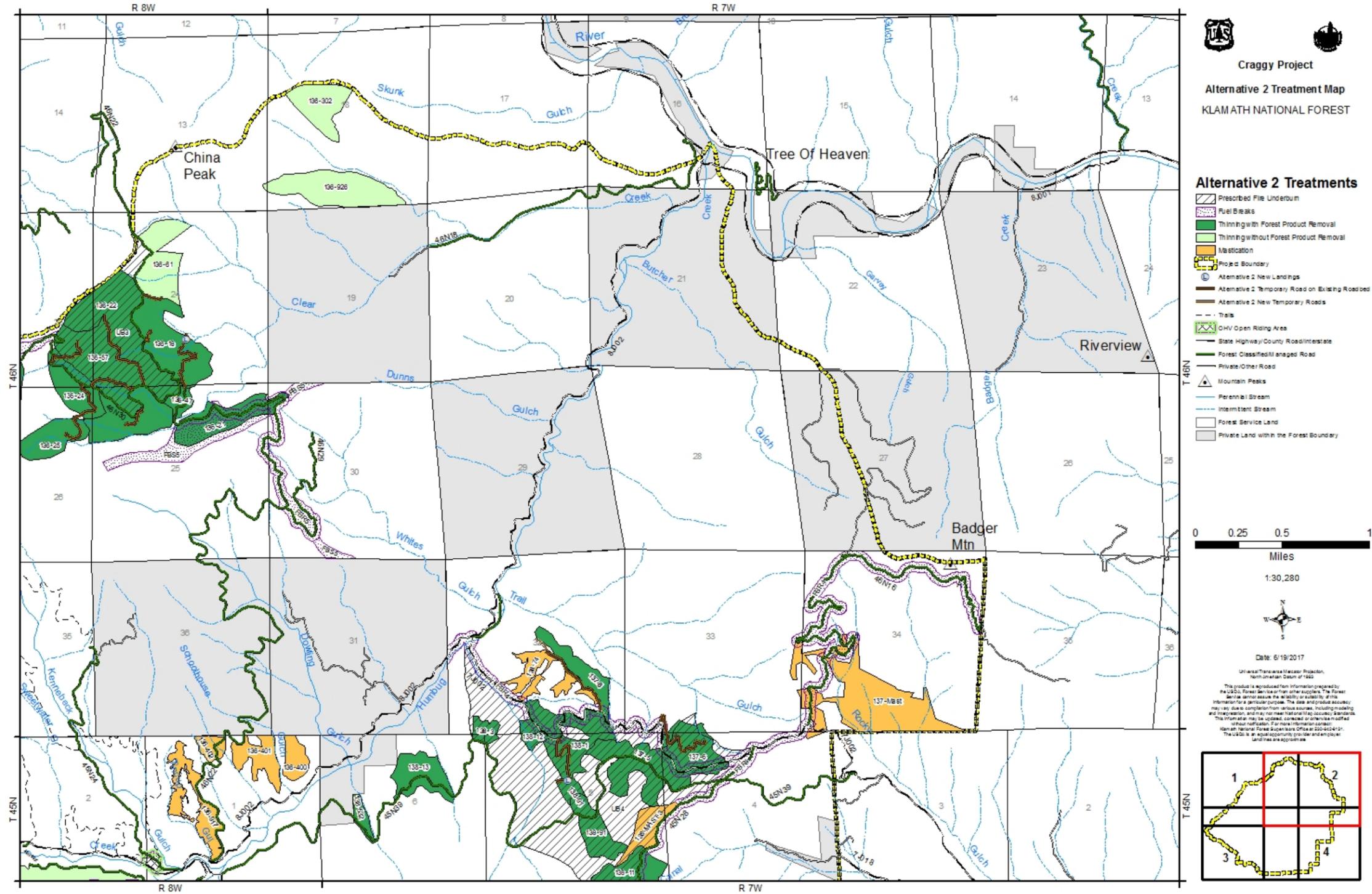


Figure B-3: Alternative 2 Treatment Map Page 2 of 4

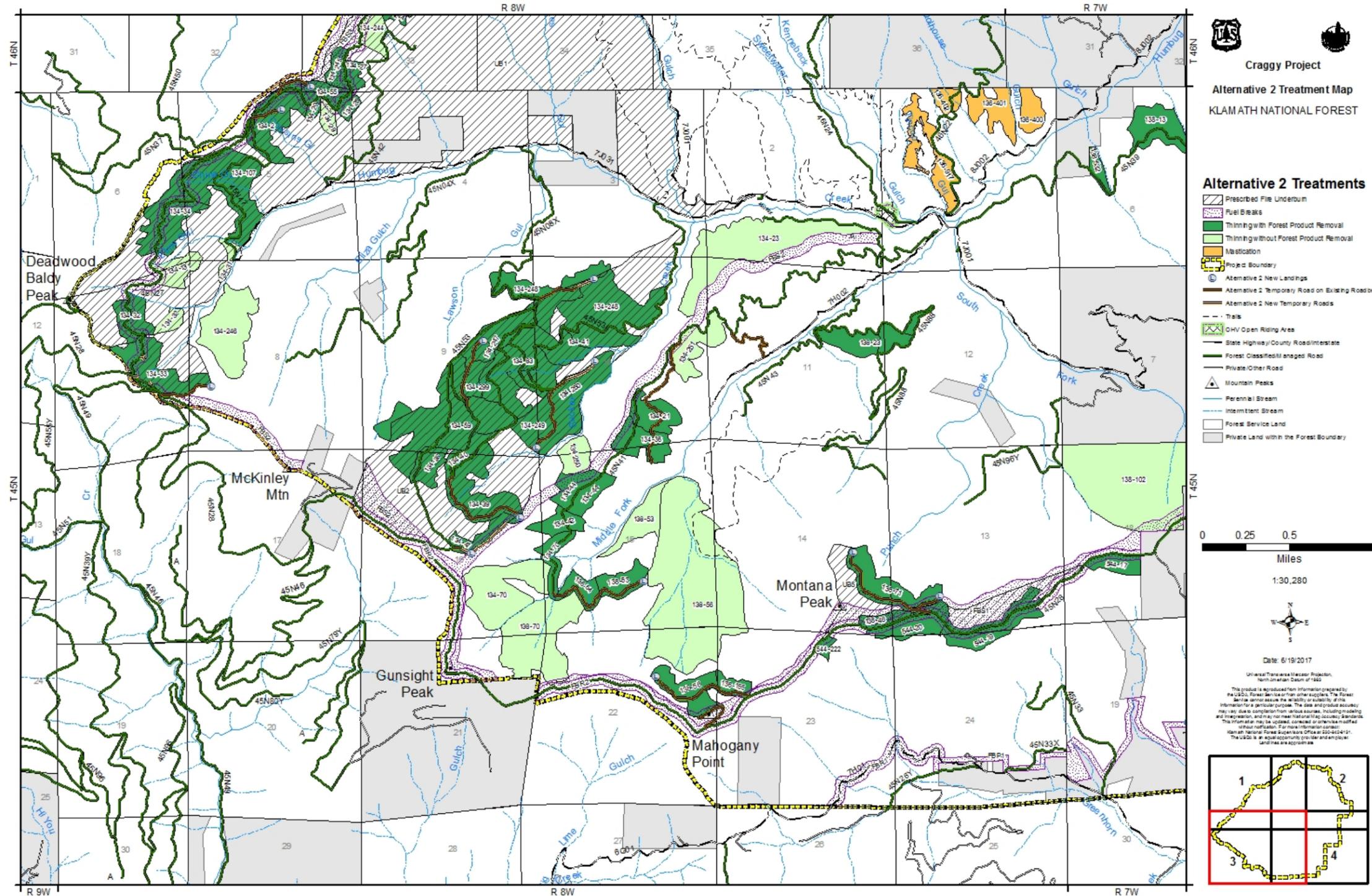


Figure B-4: Alternative 2 Treatment Map Page 3 of 4

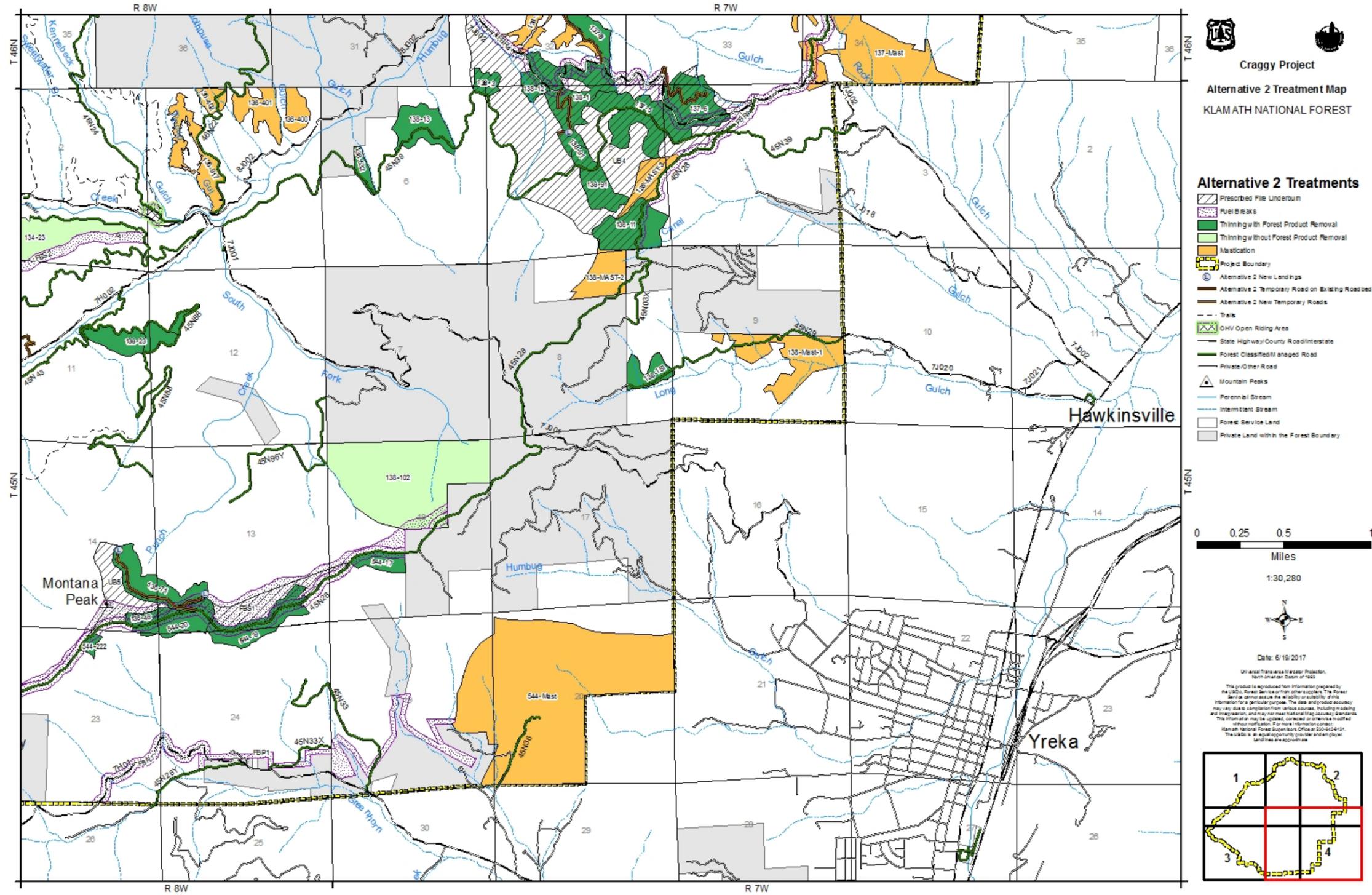


Figure B-5: Alternative 2 Treatments Map Page 4 of 4

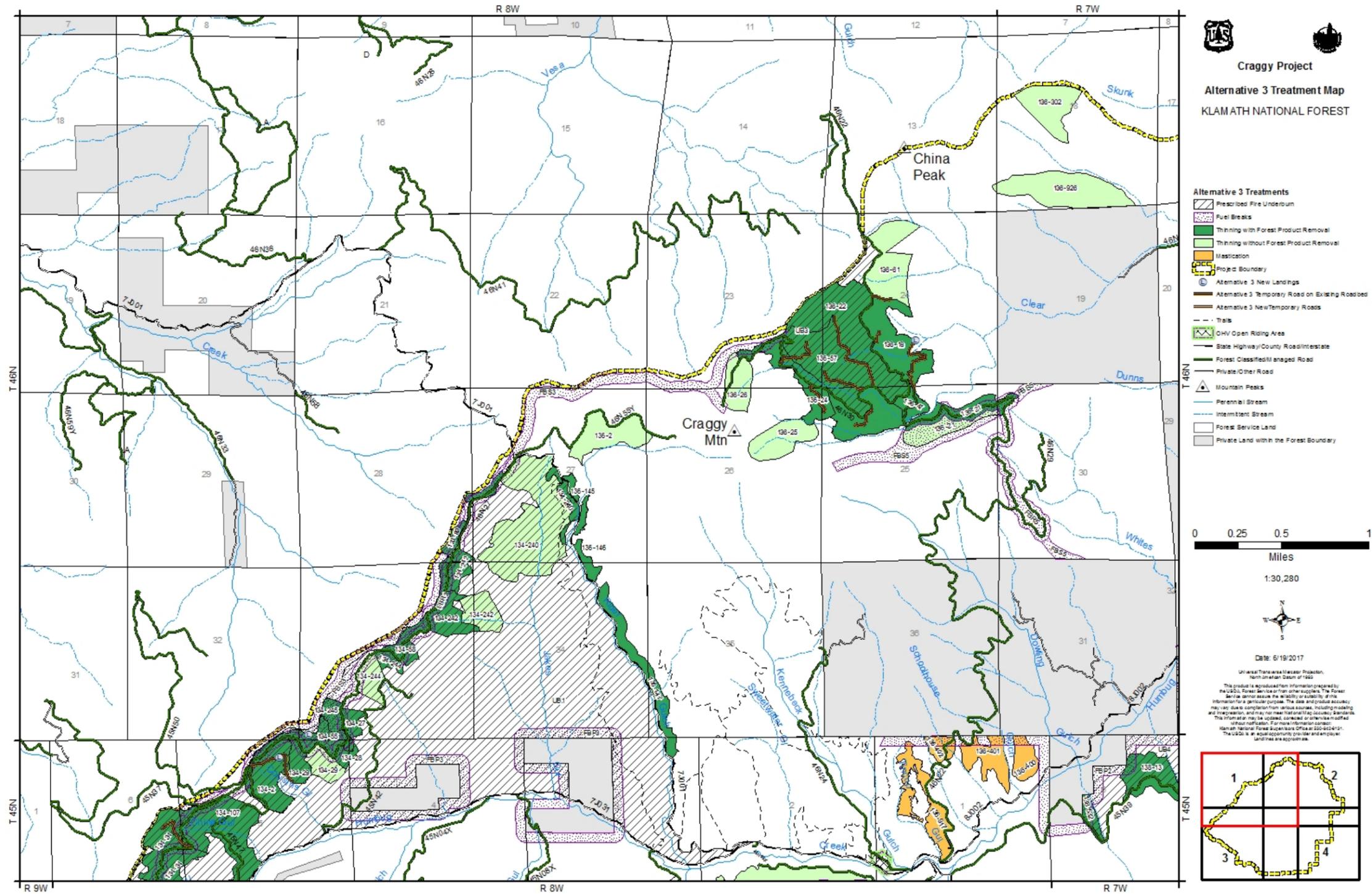


Figure B-6: Alternative 3 Treatments Map Page 1 of 4

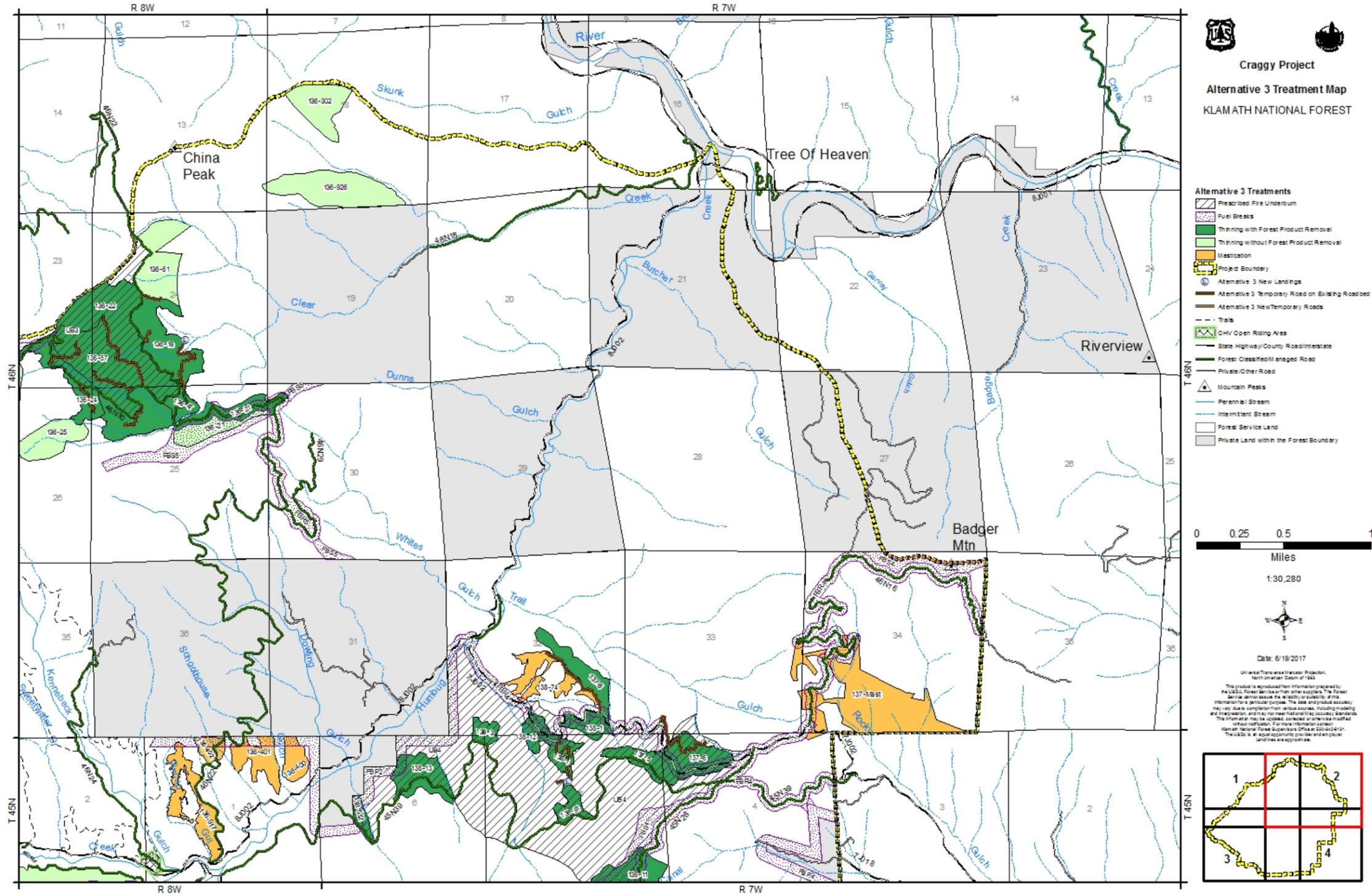


Figure B-7: Alternative 3 Treatments Map Page 2 of 4

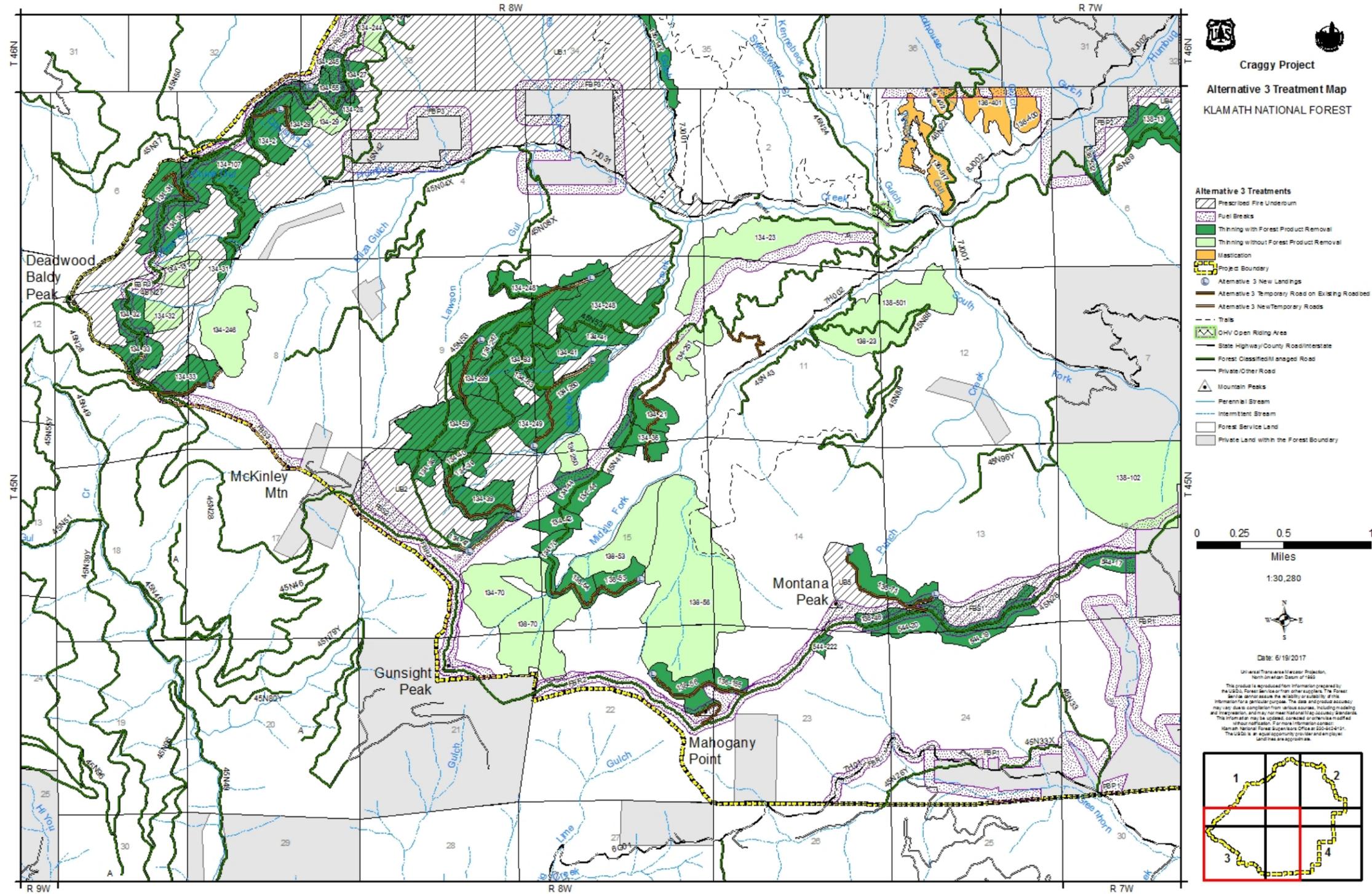


Figure B-8: Alternative 3 Treatments Map Page 3 of 4

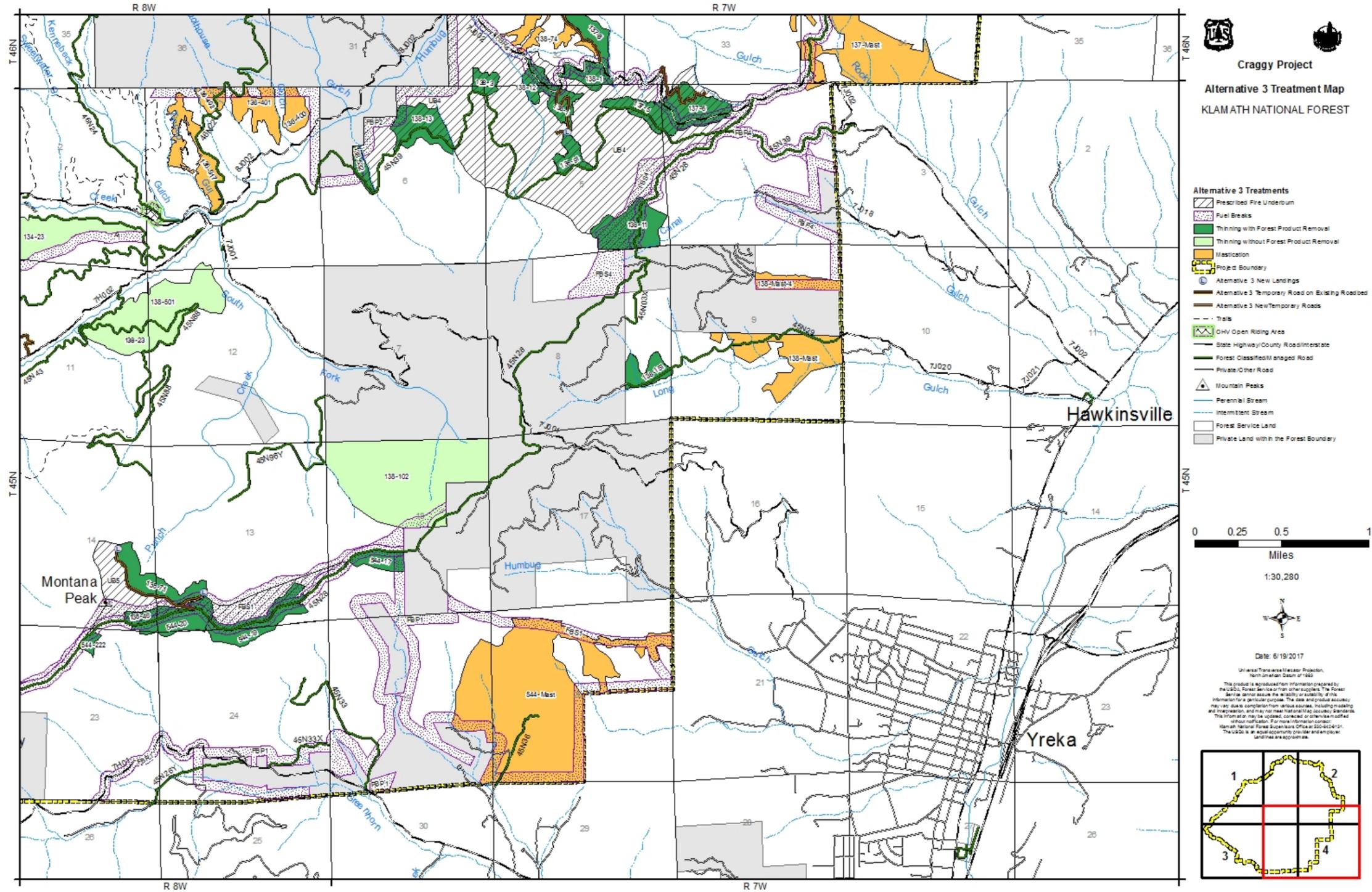


Figure B-9: Alternative 3 Treatments Map Page 4 of 4

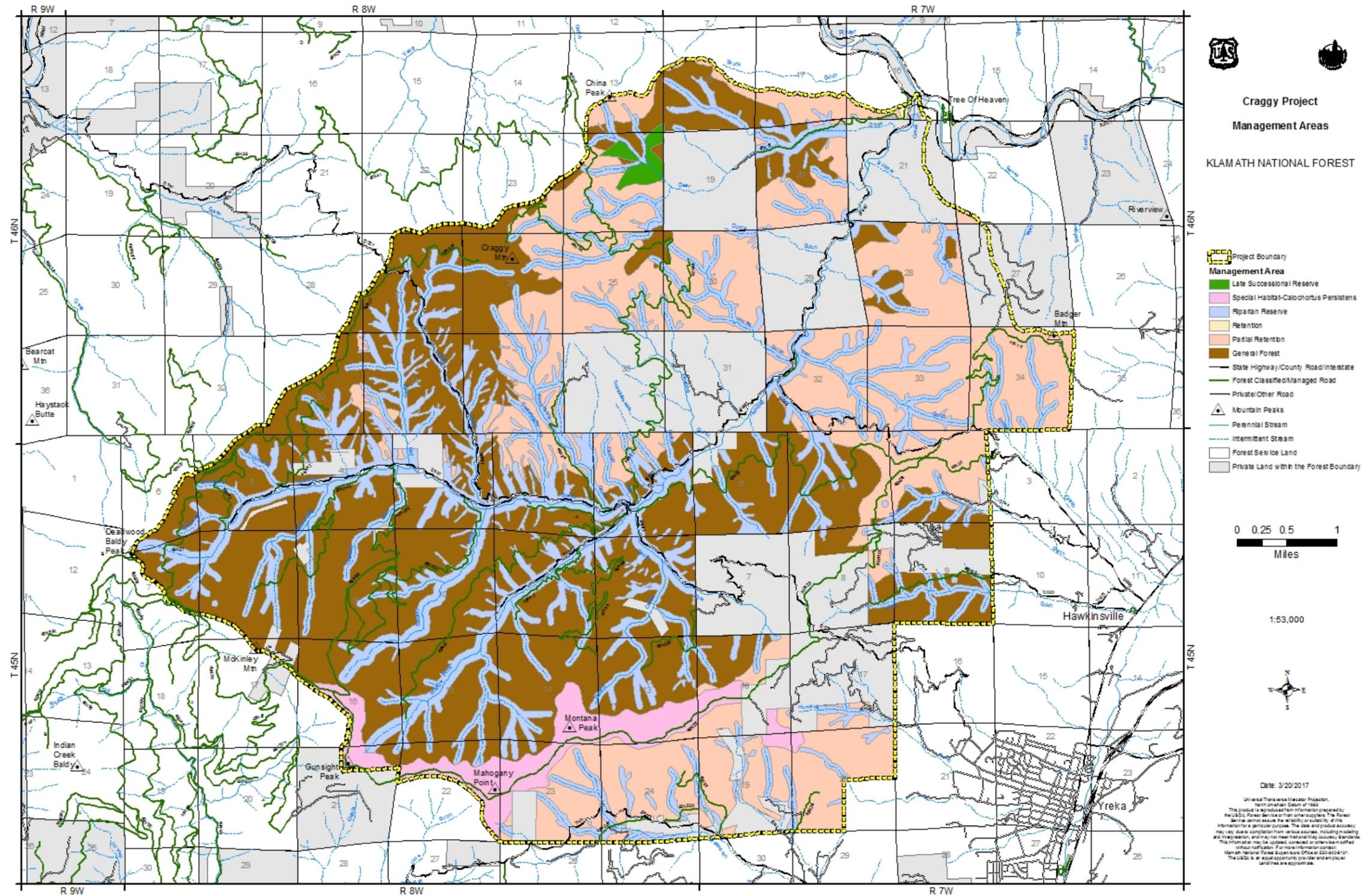


Figure B-10: Management Area Map

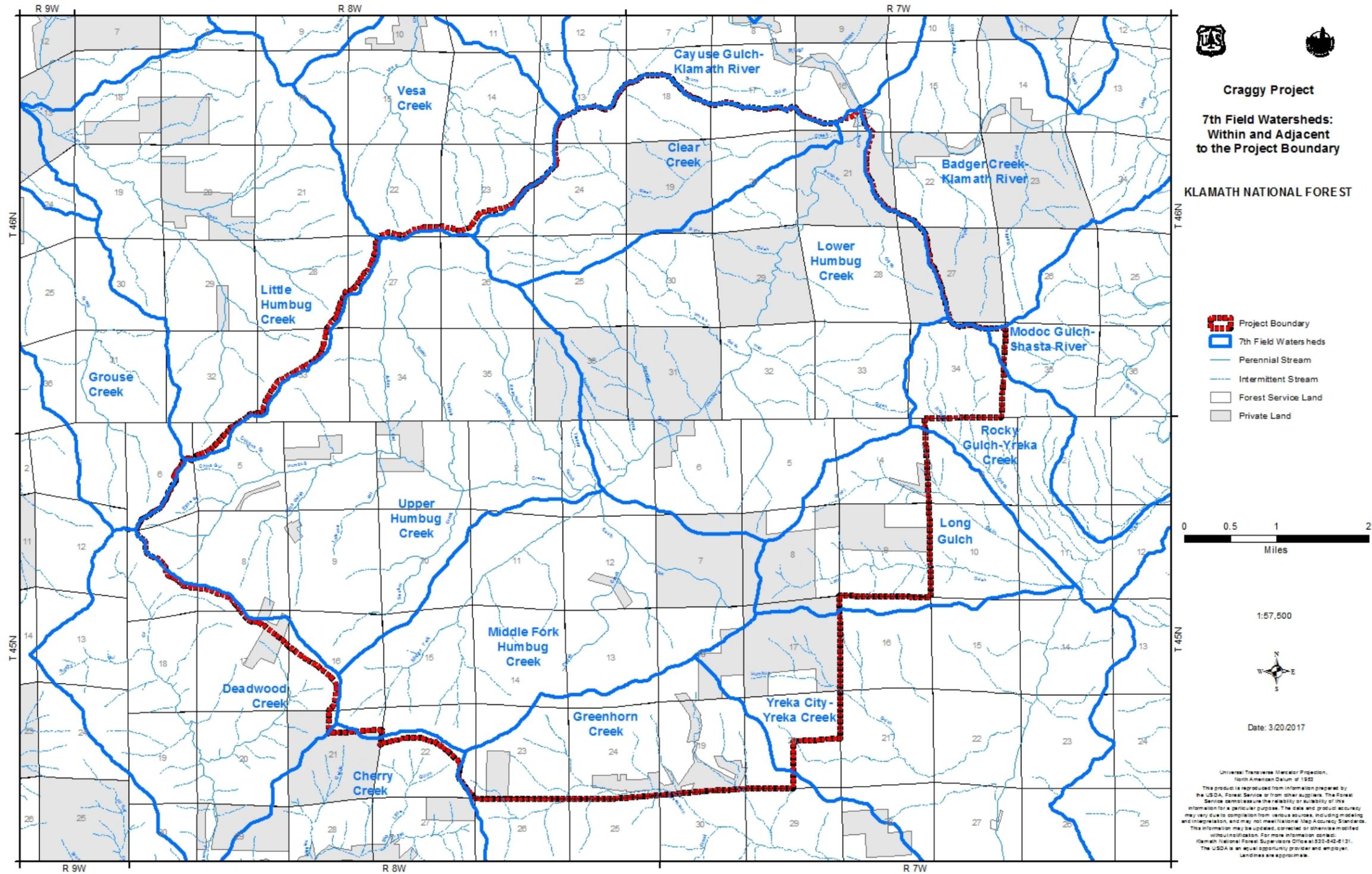


Figure B-11: Craggy 7th Field Watersheds: Within and Adjacent to the Project Boundary Map

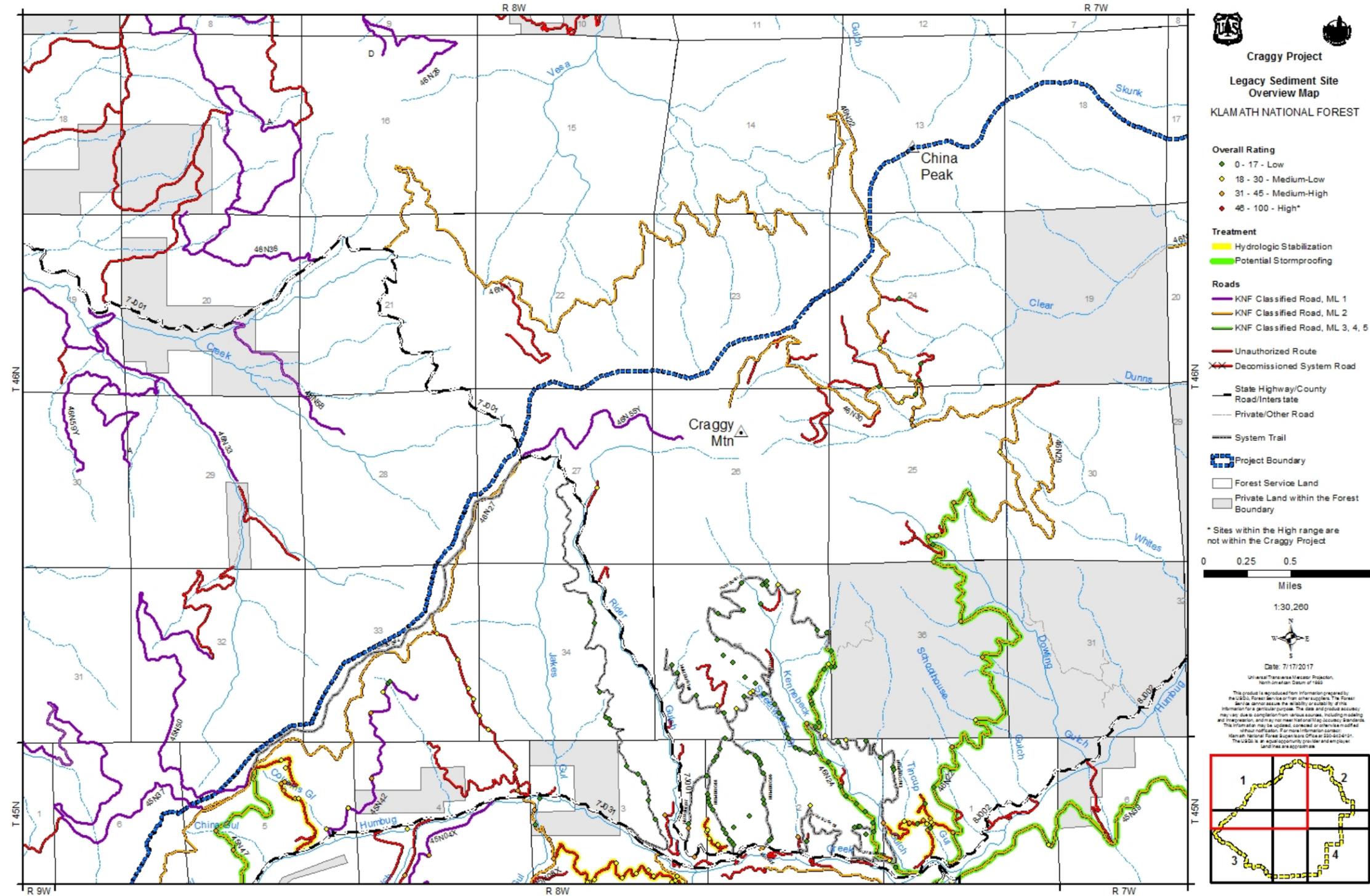


Figure B-12: Map of Locations and Risk Ratings of all Project Area Legacy Sites-page 1 of 4

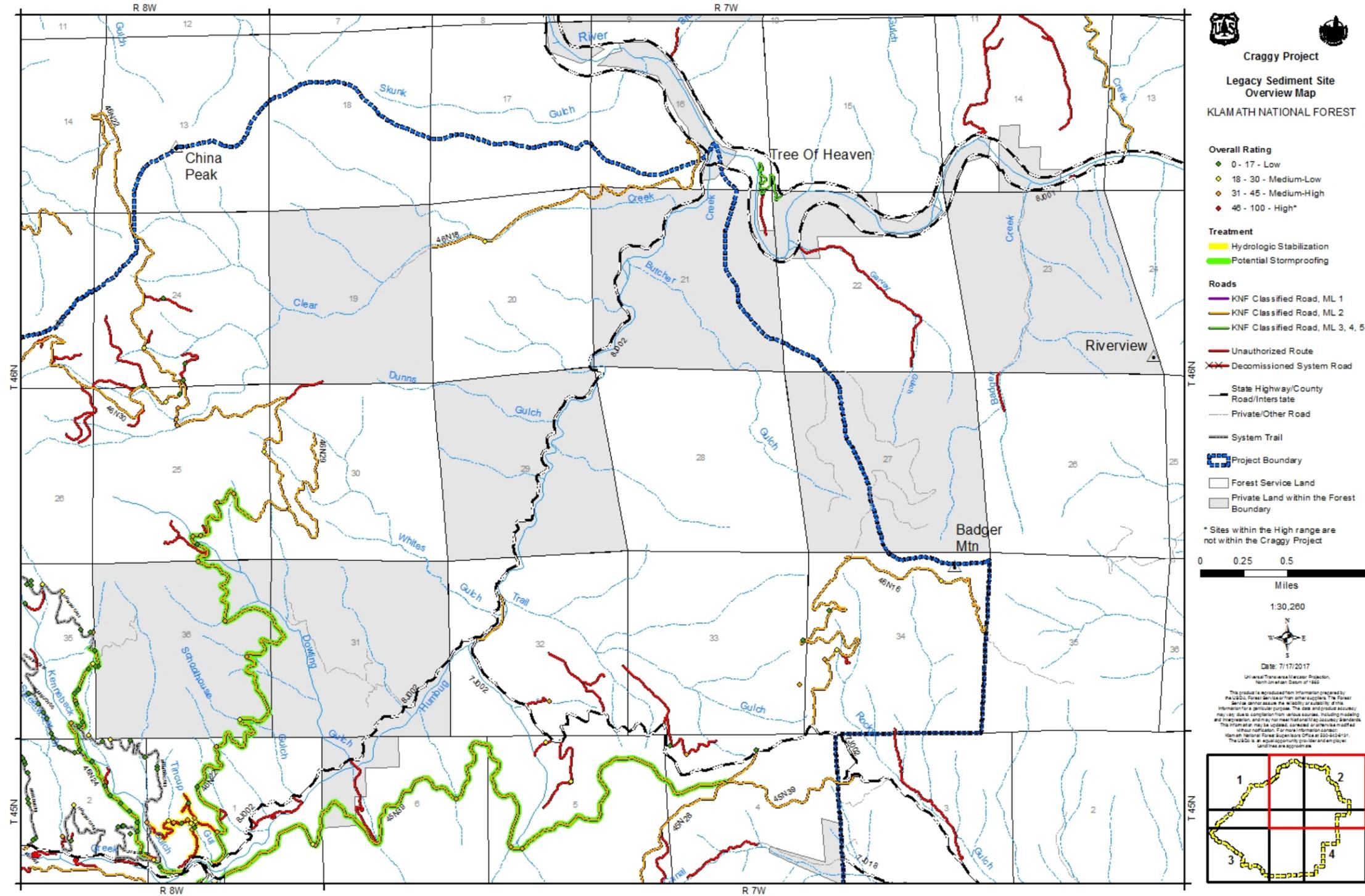


Figure B-13: Map of Locations and Risk Ratings of all Project Area Legacy Sites-page 2 of 4

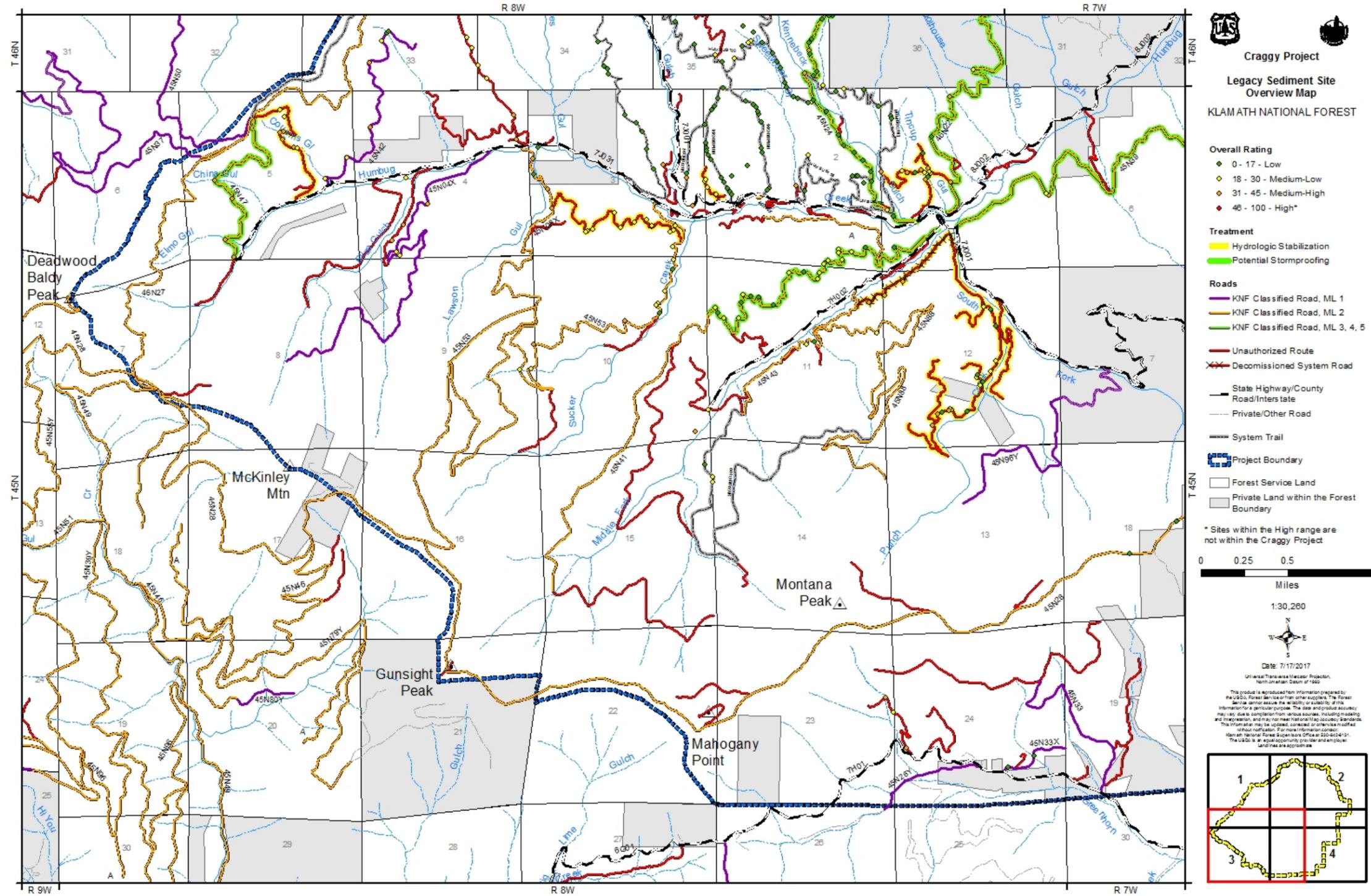


Figure B-14: Map of Locations and Risk Ratings of all Project Area Legacy Sites -page 3 of 4

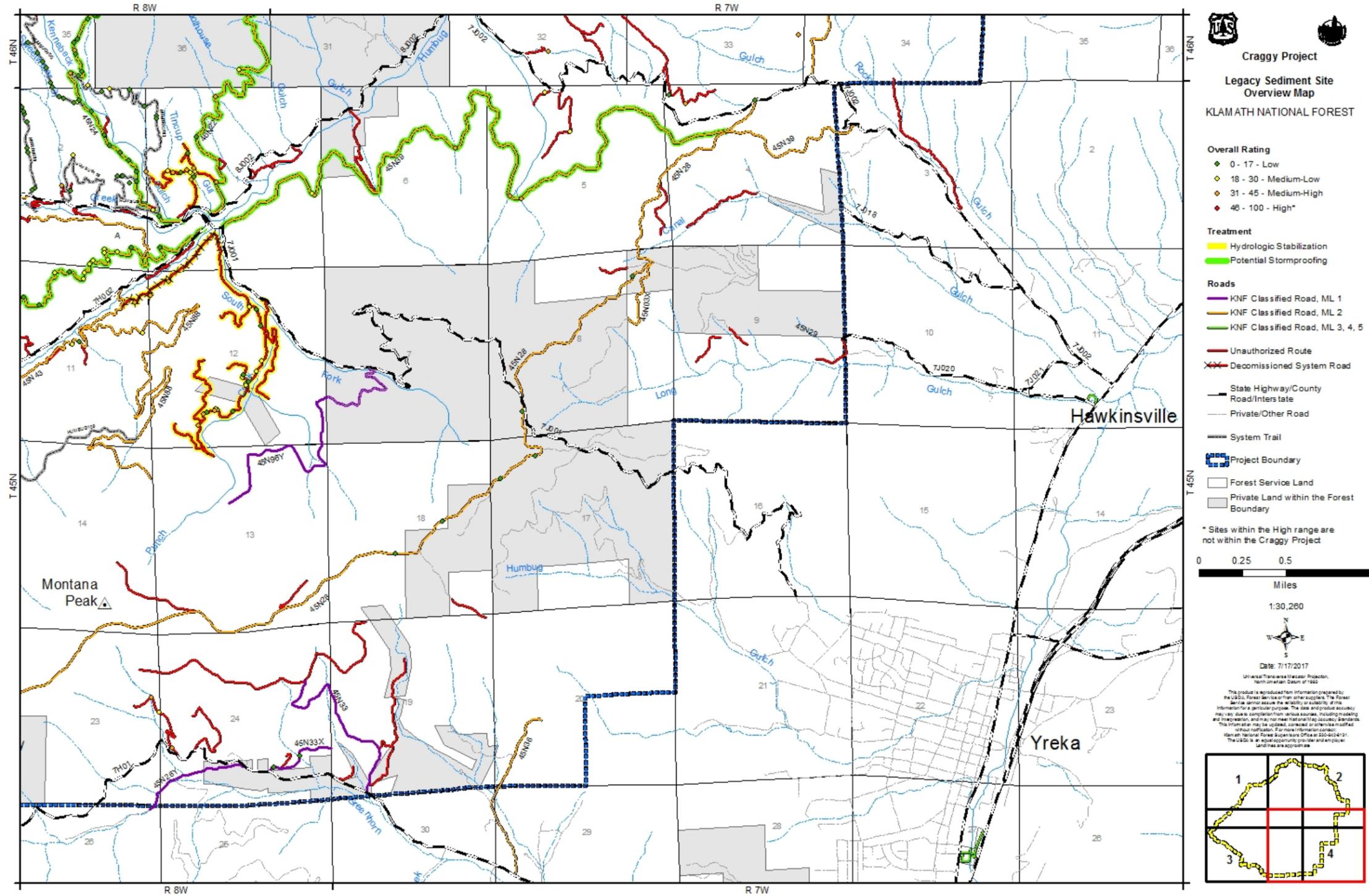


Figure B-15: Map of Locations and Risk Ratings of all Project Area Legacy Sites -page 4 of 4

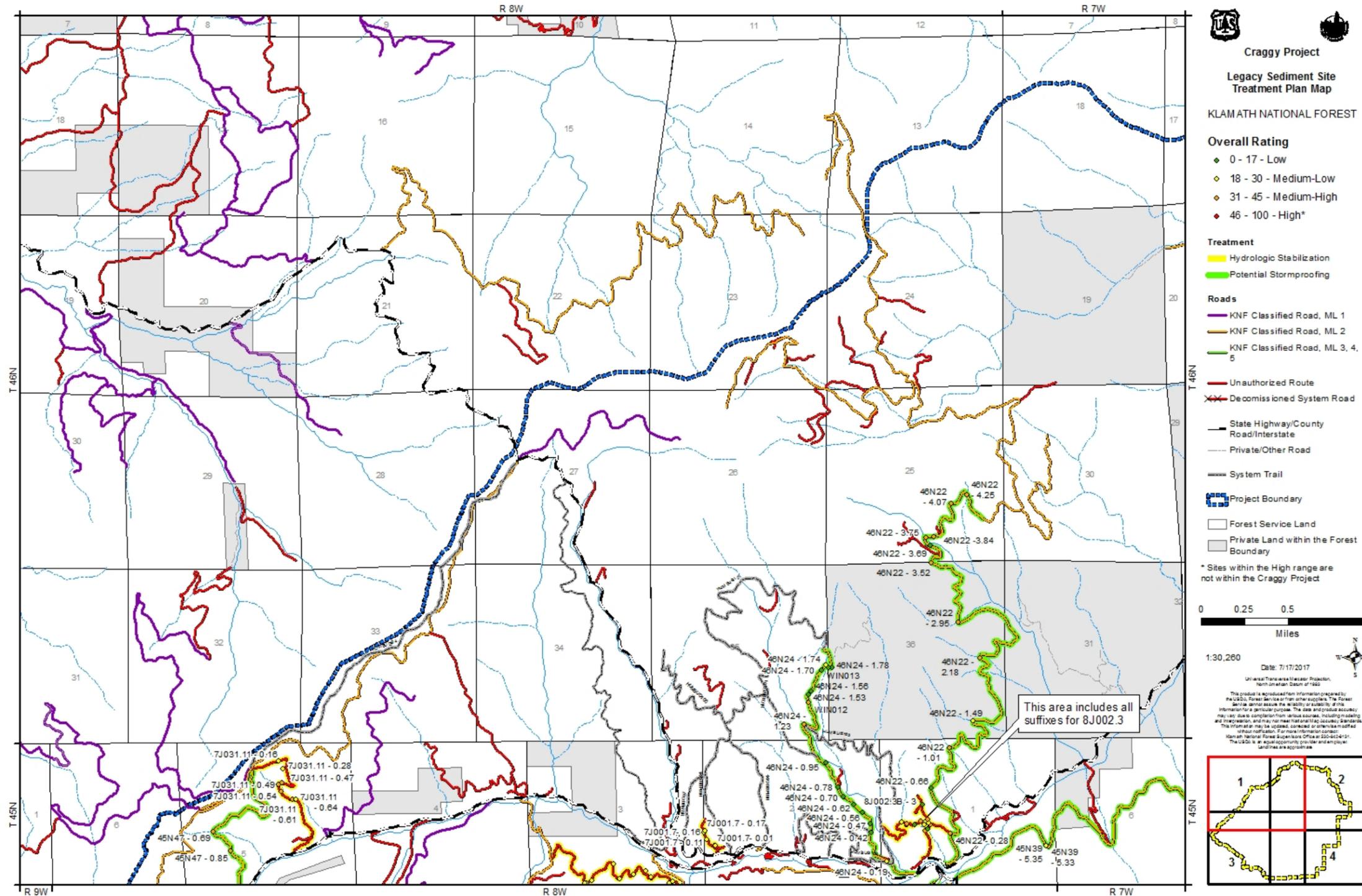


Figure B-16: Craggy Legacy Site Treatment Plan Map page 1 of 4

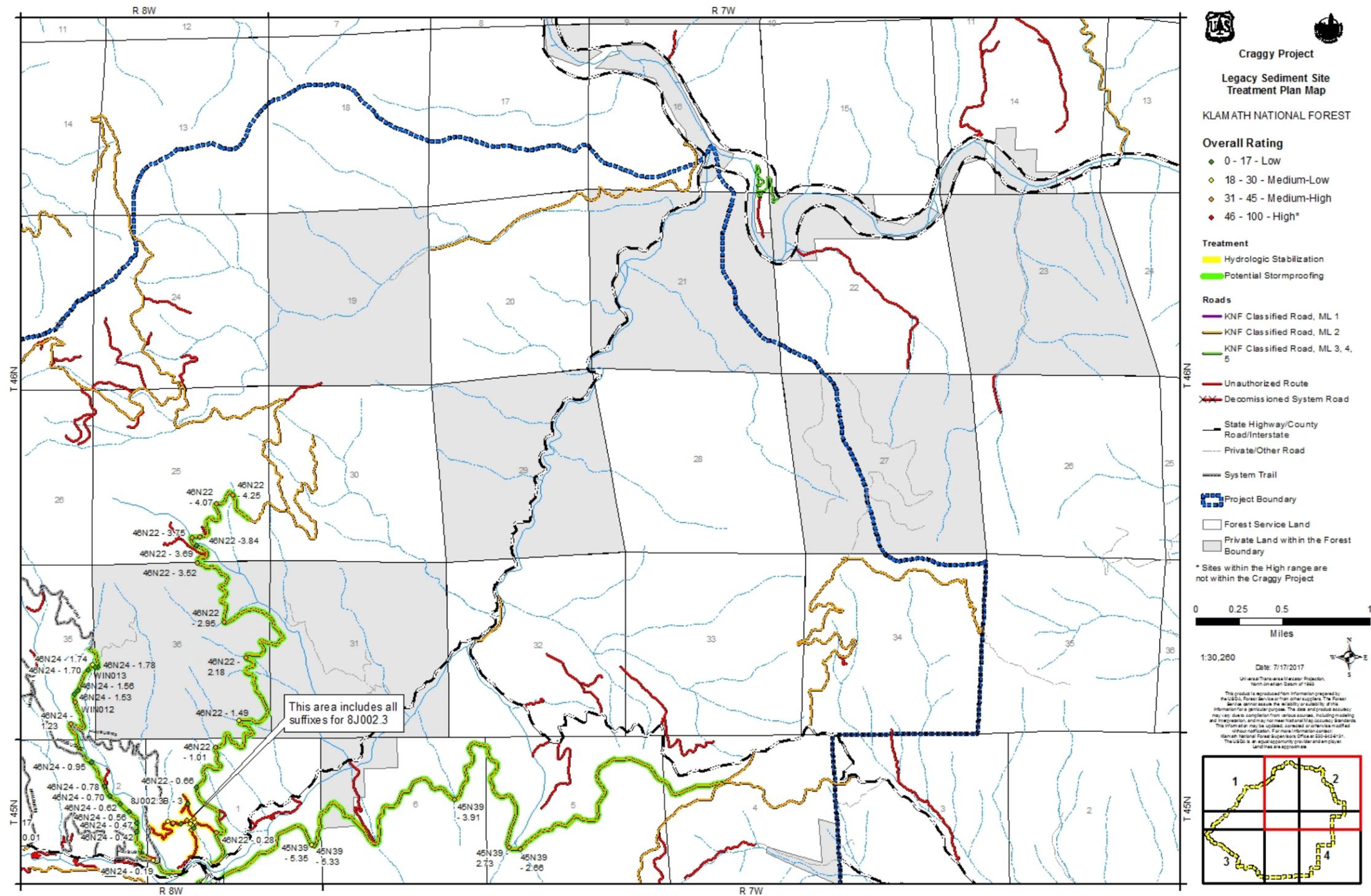


Figure B-17: Craggy Legacy Site Treatment Plan Map page 2 of 4

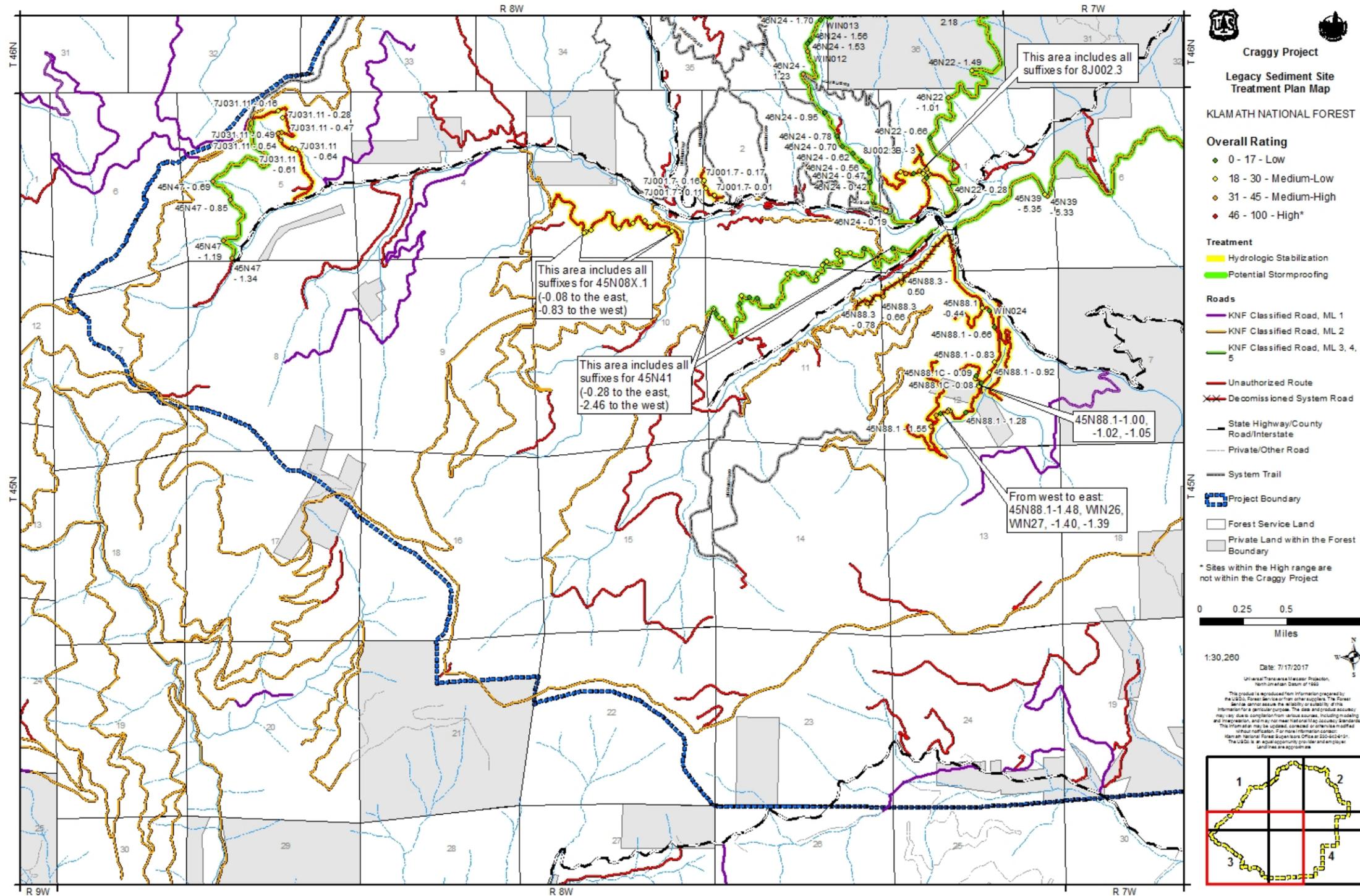


Figure B-18: Craggy Legacy Site Treatment Plan Map page 3 of 4

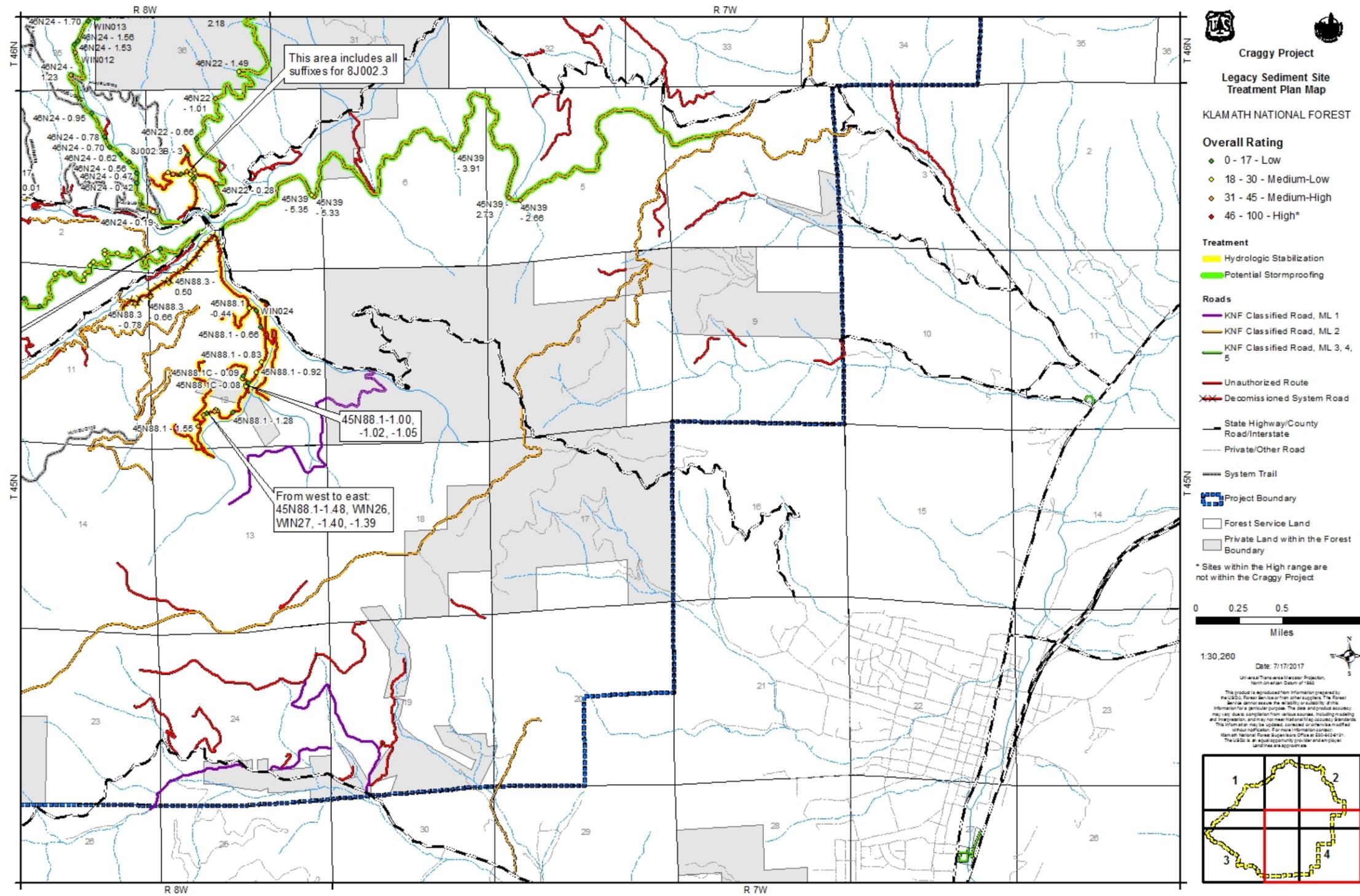


Figure B-19: Craggy Legacy Site Treatment Plan Map page 4 of 4

APPENDIX C: ACTIONS CONSIDERED FOR CUMULATIVE EFFECTS

This appendix gives a brief overview of past actions and lists the current and reasonably foreseeable future actions that may be considered in cumulative effects analysis for the proposed Craggy Project.

The past, present and reasonably foreseeable future actions that are considered for cumulative effects analysis may vary by resource (see chapter 3 of this draft environmental impact statement and resource reports for resource-specific details). For some resources, the analysis area includes only the project area or a smaller area; for other resources, the analysis area includes 7th field watersheds or Siskiyou County as a whole. Therefore, completed (past), ongoing or reasonably foreseeable actions include actions on the Forest and private land within the Craggy project area, within the eight 7th field watersheds that encompass the project area, and within Siskiyou County (if they pertain specifically to social and economic effects). Federal and non-federal actions that are not yet completed but have a signed decision or approved plan (in the case of timber harvest plans) are considered within the context of past actions.

Within the Project Area: Klamath National Forest Land

Similar actions to what will be implemented with this project, or actions within the project area that have similar effects to the project, will be considered in this analysis.

Past Actions:

In the past within the project area, many different silvicultural treatments occurred. This includes thinning of commercial- and noncommercial-sized trees, site-preparation (for planting and prescribed burning), planting of trees and other reforestation activities, various fuels treatments. These activities had a diverse range of effects (including beneficial effects) to various resources. Events such as wildfires and floods have also occurred, affecting different resources in various ways. More detail is provided in chapter 3 and applicable resource reports in the affected environment sections. Other specific actions have occurred in the past as follows.

Motorized Travel Management:

The Motorized Travel Management Record of Decision was signed on July 29, 2010. This was a Forest-wide project. The decision designated almost 20 miles of motorized trail in the project area (including *Trail 5596*, described below), about 17 miles in the Upper Humbug Creek 7th field watershed and three miles in the Middle Fork Humbug Creek 7th field watershed. Mitigation, including tread and drainage work, was required on about 14 miles of the trails in Upper Humbug Creek; further analysis including possible rerouting before being added to the Motor Vehicle Use Map was required on about four miles of trails. Required drainage and tread work was completed in 2015 as was rerouting on three miles of Trail 5596. The 2010 decision also designated a five-acre open riding area for off-highway motorized vehicles, improvements to which are described below under the *Humbug Off-highway Vehicle (OHV) Staging Area Development* project. Publication of the Motor Vehicle

Use Map on January 1, 2013 (updated in 2015) restricted all public motorized use on the Forest to designated roads, trails, and areas.

Trail 5596 (Humbug Drainage -Trail Reroutes for Resource Protection):

This off-highway vehicle trail is entirely within the Craggy project area. It is within Township (T) 46 North (N), Range (R) 8 West (W), Sections 27 and 34; and T45N R8W Section 3; Mt. Diablo Meridian, in the Upper Humbug Creek 7th field watershed. Work on this motorized trail was completed in November, 2015; the motorcycle trail will be added to the Motor Vehicle Use Map in the next update of the map. This trail previously existed as two unauthorized routes. In the decision to reroute parts of the trail and decommission old segments to better protect various resources, new segments were chosen that would improve protection of resources by avoiding riparian reserves, avoiding noxious weed populations, providing smoother transitions with the existing trail, and improving the ability to constrain riders to the trail. A goal with the Trail 5596 project was to provide a sustainable motorized opportunity for motorcycle riders while protecting resource conditions and providing erosion control.

Humbug Off-highway Vehicle (OHV) Staging Area Development:

The Humbug OHV Staging Area Development project is located entirely within the Craggy project area. It is within T45N, R8W, Section 1, Mt. Diablo Meridian, in the Upper Humbug Creek 7th field watershed. It includes the construction of OHV visitor facilities for an enhanced recreational experience and resource protection. A single entrance, graveled parking area, double vault toilet, loading/unloading ramp, a children's riding area, signs, definition of use areas with fencing or boulders, two individual tables with fire rings, a group picnic area, and a sediment basin have all been completed. The project area is about two acres in size and provides support to about five-acres of the open riding area. Work on this project was completed in 2016.

Mining:

Past historic mining occurred in the project area and within the eight 7th field watersheds in which the project area is located. The effects of this mining are included in the affected environment section of Chapter 3 and relevant resource reports.

Ongoing Actions:

There aren't any ongoing actions by the Forest Service within the project area, other than current on-going use and maintenance of roads and trails.

Reasonably Foreseeable Future Actions:

There aren't any reasonably foreseeable future actions by the Forest Service within the project area other than the Craggy project.

Within the Project Area: Private Lands and Other Agencies

Past Actions:

The effects of timber harvest plans and fuel reduction actions on private land are included in the affected environment descriptions in Chapter 3. Specific effects of these actions, and of past mining activities, are included in the cumulative watershed effects modeling as part of

the current situation. There are no known fuel reduction actions on other private property or agency-managed land within the project area.

Ongoing Actions:

There aren't any known ongoing actions within the project area on private lands or those managed by other agencies other than the sale based on the Badger Timber Harvest Plan (THP): 2-16-012 SIS. This project is within Siskiyou County, California, within T46N, R7W, Section 27; Mt. Diablo Meridian. The timber owner is Michigan California Timber Company. This project is treating about 48 acres within the Lower Humbug Creek 7th field watershed by clearcutting and shelterwood removal with tractor logging.

Reasonably Foreseeable Actions:

Within the 7th Field Watersheds: Klamath National Forest Lands

Past Actions:

Past actions that occurred on the Klamath National Forest within the eight 7th field watersheds may be considered to have had similar effects compared to what is briefly described above for past Forest Service activities within the project area.

Ongoing Actions:

There aren't any ongoing actions by the Forest Service within the 7th field watersheds other than those within the project area.

Reasonably Foreseeable Actions:

There aren't any reasonably foreseeable future actions by the Forest Service within the 7th field watersheds other than the proposed Craggy project.

Within the 7th Field Watersheds: Private Lands and Other Agencies

Past Actions:

Past actions that occurred on private land associated with timber harvest plans, that are within the eight 7th field watersheds, may be considered to have had similar effects compared to what is briefly described above for past private timber harvest plan activities within the project area. For effects of timber harvest plans within the project area, see the applicable resource reports for more detailed information.

Past actions not associated with timber harvest plans include various fuels reduction and watershed restoration projects which are listed below.

Visitor Center (Yreka City -Yreka Creek 7th field):

This project is within Siskiyou County, California, within T45N, R7W, Section 27; Mt. Diablo Meridian. It covered an eighth-mile portion of Yreka Creek. It created a visitor center, trails, bridges, planted native plants (and removed invasive plants), and created various interpretive and informational media.

Storm Water Attenuation (Yreka City -Yreka Creek and Greenhorn Creek 7th fields):

This project is within Siskiyou County, California, within T45N, R7W, Sections 27 and 33; Mt. Diablo Meridian. It upsized key storm drains, added hydrodynamic separators to filter out pollutants, installed two large attenuation basins to intercept and slow down runoff, deepened a portion of Greenhorn Reservoir to increase storm water retention capacity, installed a sediment basin on Greenhorn Creek above the reservoir to capture sediment before entry into the reservoir, lowered and widened the Yreka Creek floodplain, constructed overflow channels, and re-vegetated with native species along a third mile of Yreka Creek north of East Oberlin Road.

Greenhorn Reservoir Loop Trail Project (Greenhorn Creek 7th field):

This project is within Siskiyou County, California, within T45 N, R7W, Sections 33 and 34; Mt. Diablo Meridian. At Greenhorn Park, a trail bridge was installed, one mile of trail was paved, and restroom facilities were installed.

Upper Greenhorn Creek Floodplain Restoration and Trails Project- Phase 1 (Greenhorn Creek 7th field):

This project is within Siskiyou County, California, within T45N, R7W, Section 33; Mt. Diablo Meridian. It lowered and widened the floodplain, constructed overflow channels, restored eroded banks, planted native species, and upgraded trails along a quarter mile portion of Greenhorn Creek just above Greenhorn Reservoir.

North Yreka Deer Creek Project (Yreka City -Yreka Creek 7th field):

This project is within Siskiyou County, California, within T45N, R7W, Section 14; Mt. Diablo Meridian. It lowered and widened the floodplain, constructed overflow channels, revegetated with native species, installed a paved trail, picnic area, and trailhead facilities along a quarter mile of Yreka Creek at the north end of the town of Yreka.

Ongoing Actions:

Ongoing actions for private timber harvest plan projects are similar to their past actions.

Evergreen School Bio-swales Project (Yreka City -Yreka Creek 7th field):

This project is within Siskiyou County, California, within T45N, R7W, Section 27; Mt. Diablo Meridian. It consists of constructing several large bio-swales with retention basins at Evergreen Elementary School to capture storm runoff from school buildings and parking areas that originally all flowed to the street. The first phase was completed in 2015 and the second phase will be completed sometime in 2016. The bioswales are being re-vegetated with native species.

Oberlin-Young Trail Improvement Project (Yreka City-Yreka Creek 7th field):

This project is within Siskiyou County, California, within T45N, R7 W, Section 27; Mt. Diablo Meridian. It consists of lowering and widening additional floodplain areas, constructing a bio-swale, re-vegetating with native species, and installing paved main and secondary trails, unpaved tertiary trails, trail bridges and boardwalks, picnic areas, and trailhead facilities along a half mile of Yreka Creek north of East Oberlin Road.

Visitor Center Maintenance (Yreka City -Yreka Creek 7th field):

This project is within Siskiyou County, California, within T45N, R7W, Section 27; Mt. Diablo Meridian. It includes continued removal of invasive plants.

Reasonably Foreseeable Actions:

Yreka Flood Hazard Reduction Project - implementation is planned to begin in August of 2017 (Yreka City -Yreka Creek 7th field):

This project is within Siskiyou County, California, within T45N, R7W, Sections 23, 27, and 34; Mt. Diablo Meridian. The central reach includes the Klamath National Forest Service Center. The portion of the project on land managed by the Forest proposes the removal and replacement of a retaining wall, floodplain lowering and widening, vehicular bridge replacement, main channel re-routing, overflow and side channel construction, and re-vegetating with native species along a quarter mile of Yreka Creek.

The north reach is located between Lennox Street and Montague Road (Highway 3) and the south reach is located between East Oberlin Road and Sharps Road. Activities along these two reaches includes floodplain lowering and widening, main channel re-routing, overflow and side channel construction, and re-vegetating with native species along a half mile of Yreka Creek at each reach (totaling one mile of creek).

Lower Yreka Creek Full Restoration Project and Side Channel Project (Yreka City - Yreka Creek, Rocky Gulch -Yreka Creek, and Long Gulch 7th fields):

This project is located within Siskiyou County, California, within T45N, R7W, Sections 1, 11, 12, and 14; Mt. Diablo Meridian. This project proposes restoration of Yreka Creek starting at its confluence with the Shasta River and continues upstream along Yreka Creek for about two miles with a total of about 125 acres overall. These two miles will not all be treated at once, this project has been broken down into phases, with phase one activities focusing first at the confluence of Yreka Creek with the Shasta River.

Phase one will restore about two acres of floodplain and riparian woodland through levee removal, floodplain excavation (to make it more accessible), and installation of native plant species. It will also install 650 feet of side channels immediately adjacent to the Shasta River confluence, with several pools, rock vane structures, large woody debris and extensive spawning gravel placement. Focusing phase one at the confluence will yield the greatest near-future benefit to Coho Salmon and other species.

Desired outcomes include creating a more accessible floodplain and a ground surface closer to the water table; increasing habitat and water quality for salmonids, other aquatic species, and wildlife (this specifically includes beavers); and improving the ecological health and function of the creek.

Fuel Reduction on lands managed by the Bureau of Land Management (Long Gulch and Rocky Gulch -Yreka Creek 7th field watersheds):

This project is located within T45N, R7W, Sections 3, 2 and 10; Mt. Diablo Meridian and consists of up to 200 acres of fuel reduction to be implemented in a three to five year period. Although planning and funding are not complete for this project, possible treatments are hand thinning (with chipping and/or pile burning), mastication (in dense brush areas), goats (in grassier fuel models and where star thistle and/or other exotics are present in large quantities, herbicide (for exotic plants), and pile burning (if needed).

City of Yreka WUI Hazardous Fuels Reduction Project on private land (Rocky Gulch-Yreka, Long Gulch, Yreka City-Yreka Creek, Greenhorn and Middle Humbug 7th field watersheds):

This project is located primarily within T45N, R7W, Sections 3, 4, 7, 8, 9, 10, 11, 16, 17, 18, 19, 30 and 31; T45N, R8W, Sections 24, 25 and 36, and R44N, R8W, Section 1 of the Mt. Diablo Meridian. A proposed fuelbreak surrounding the Forest boundary would also include treatments in T45, R7W, Sections 15, 20, 21 and 29; and T45N, R8W, Section 26. The funded project will consist of about 260 acres of fuel reduction to be implemented within five years. Possible treatments include thinning and removing vegetation less than 10 inches in diameter; removing limbs from leave trees to a minimum of eight to 12 feet above ground; strategic removal of brush and ladder fuels; and providing firewood-size cut trees for use by the community. Treated fuels will be hand piled and burned, ground or chipped.

Within Siskiyou County on National Forest Lands

Past Actions:

Actions at the county level are noted primarily for the purpose of analyzing the effects on social and economic resources. Past actions at the county level are not listed here but are summarized in chapter 3 of this environmental impact statement and the social and economic resource report, more information is provided about the effects of various projects. Effects on the social and economic resource are analyzed up to about 20 years prior (in order to include the most recent census data) to the start of analysis in order to capture meaningful and applicable information to compare a project's effects to.

Siskiyou County includes portions of the following national forests: Six-Rivers, Shasta-Trinity, Modoc, and the Klamath. Among these national forests, past activities similar to what is proposed for this Craggy Project have occurred. Forest products for multiple-uses have been made available, forest health has been improved, fire resiliency has been improved, watershed restoration activities have occurred, and other key activities have occurred. Effects have been both beneficial and negative, depending on the situation and resource, and jobs have been created or sustained through these projects.

Ongoing Actions:

Ongoing actions within Siskiyou County on national forest lands are similar to what is described for past actions in Siskiyou County on national forest lands; this includes the Westside Fire Recovery project, the Jess Project on the Klamath National Forest, and the Elk Late-Successional Reserve Enhancement Project on the Shasta-Trinity National Forest.

Reasonably Foreseeable Actions:

The schedules of proposed actions were reviewed for all national forests that manage land within Siskiyou County; up-to-date information on expected dates for decisions and implementation will be provided with updates of the schedules. Only the Klamath and Shasta-Trinity national forests are proposing projects in Siskiyou County that may be considered in the cumulative effects analysis.

Klamath National Forest:

1. **Harlan Environmental Assessment** - The current expected decision date for this project is September of 2018, with an expected implementation date in December of 2018. It is a vegetation management and fuels reduction project with an emphasis on improving forest resilience to wildfire and insects and disease, while improving mule deer habitat.
2. **Pumice Vegetation Management Project Environmental Impact Statement** - This project is in progress; a notice of intent to prepare an environmental impact statement was published in the Federal Register on July 11, 2011. The estimated draft environmental impact statement notice of availability in the Federal Register is currently expected in July of 2017, with an expected decision by November of 2017, and expected implementation by December of 2017. This project will reduce fuel loads and improve forest health. The project area is about 9,056 acres, with about 6,473 acres of treatment. It encompasses fuels management, vegetation management (other than forest products), and forest products including Christmas trees.
3. **Six Shooter Project Environmental Assessment** - Its expected decision is in August of 2017, with an expected implementation date of September of 2017. This project will focus on vegetation management and fuels reduction with an emphasis on improving mule deer habitat. The project area is about 15,067 acres, with about 13,806 acres of treatment.
4. **Crawford Vegetation Management Project Environmental Impact Statement** - The notice of intent to prepare an environmental impact statement for this project was published in the Federal Register on January 27, 2014. The expected decision date is for April of 2018 with an expected implementation date of June of 2018. It proposes to thin stands for forest health and fuels reduction. The fuels treatments potentially include underburning and pile burning on about 1,600 acres.
5. **Elk Creek Watershed Project Environmental Impact Statement** - The proposal is currently being developed with an estimated date for the notice of intent to prepare an environmental impact statement to be published in the Federal Register in August of 2017. The expected decision is for March of 2019, with an expected implementation date of May of 2019. It is an integrated resource management project that aims to improve physical and biological conditions in the Elk Creek watershed. As the project is still in the development phase, the project and treatment acres are not fully established yet.
6. **Happy Camp Community Fire Hazard Reduction Project Categorical Exclusion** – This project started the scoping phase on January 26, 2017. The expected decision is for September of 2017, with an expected implementation shortly thereafter. About 300 acres of fuels reduction treatments would be accomplished by brushing, thinning small trees, pruning, and reducing ground fuels; and controlling burning using prescribed fire.
7. **Horse Creek Community Protection and Forest Restoration Project** – This project is currently in progress. The objection period legal notice was on June 23, 2017. The expected decision is in September of 2017, with an expected implementation date shortly thereafter. This project includes fuels reduction, hazard tree removal, and site preparation and planting within the Gap Fire area.

8. **Upper North Fork Salmon Fuels Reduction** – The scoping started on September 22, 2016. The expected decision is in October of 2017, with an expected implementation date shortly thereafter. This project plans to treat up to 120 acres with high priority fuels reduction and prescribed fire on private land within the Upper North Fork of the Salmon River, including Sawyers Bar and outlying neighborhoods.
9. **East Fork Scott** – The proposal for this project is currently being developed. The notice of intent is estimated to be in the Federal Register in August of 2017. The expected decision and implementation is for February of 2019. This project proposes to improve conditions within the East Fork Scott watershed. Treatments within 31,540 acres may include meadows, riparian areas, fuels reduction, mine reclamation, stand density reduction, and wildlife habitat improvements.
10. **Scott Bar Mill Creek Fuels Categorical Exclusion** - The planning is complete. The decision date was June 5, 2017 with implementation planned to occur in September of 2017. The objectives of this project are to reduce hazardous fuels to protect private property and to improve wildlife habitat and protect salamander habitat.
11. **Somes Bar Integrated Fire Management** - This project is in progress. Scoping started on February 21, 2017. The notice for the comment period is estimated for June of 2017. The expected decision is in September of 2017 with an expected implementation in October of 2017. The project removed fuels prior to prescribed burning in plantations 40 years and older, and mature natural stands while enhancing cultural and ecological plant species.
12. **Yellow Jacket Ridge Environmental Assessment** - The proposal is currently being developed. The estimated start of scoping is for September of 2017. The expected decision is for March of 2018, with an expected implementation date in April of 2018. This project proposes to use noncommercial thinning, release and fuels reduction in plantations and in natural stands on about 2,600 acres along Yellow Jacket Ridge.
13. **Lover's Canyon Environmental Assessment** - This project is currently in progress. The start of scoping was September 6, 2013. The estimated comment period on the draft environmental assessment is to begin in August of 2017. The expected decision is for October of 2017, with an expected implementation date in November of 2017. The project proposes to treat about 4,525 acres including commercial thinning of about 872 acres, noncommercial thinning of about 1,175 acres, the creation of fuel breaks on about 255 acres, and underburning on about 2,223 acres.

Shasta-Trinity National Forest:

1. **Highway 89 Safety Enhancement and Forest Ecosystem Restoration Project Environmental Impact Statement** - The notice of intent was published in the Federal Register on September 15, 2015, it is currently in progress. The estimated draft environmental impact statement notice of availability is for July of 2017. The expected decision is for June of 2018, with an expected implementation date shortly thereafter. This project will treat vegetation for public safety improvement, forest health, fire restoration, infrastructure, and wildlife habitat enhancement.

2. **East McCloud Plantations Thinning Environmental Impact Statement** - This project is currently on hold with no decision. It proposes plantation thinning to reduce tree densities and ladder fuels for vegetation management (other than forest products), fuels management, and for forest products.
3. **Lower McCloud Fuels Management Project Environmental Impact Statement** – The notice of intent was published in the Federal Register on March 22, 2016. The estimated draft environmental impact statement notice of availability is for June of 2018, with an expected decision for May of 2020, and expected implementation shortly thereafter. This project includes mechanical and prescribed fire fuels reduction within about 12,000 acres within the Lower McCloud and Lower Squaw Valley Creek watersheds.

Modoc National Forest:

1. **Medicine Lake Caldera Vegetation Treatment Project Environmental Assessment** - This project is currently in progress. The scoping started on September 18 of 2014. The notice for the comment period is estimated for June of 2017. The expected decision is for February of 2018 with expected implementation in July of 2018. This project proposes vegetation treatments to reduce density and add diversity to lodgepole pine stands to deter mountain pine beetle infestation and meet forest health and fuels objectives.

Within Siskiyou County on Private Lands and Lands Managed by Other Agencies

Past Actions:

Past actions within Siskiyou County on private lands may be considered to have had similar activities and effects as projects within the 7th field watersheds on private lands but at a much larger geographic extent.

Ongoing Actions:

Timber Harvest Plans (THP):

John Hancock Life Insurance Company (USA):

Lower Panther: THP #2-16-042-SIS. About 1,718 acres will be treated. It was approved on November 15, 2016.

Reasonably Foreseeable Actions:

Mill Creek II: THP #02-16-067. About 247 acres will be treated.

Fruit Growers Supply Company:

Home Boy: THP #02-15-088. About 835 acres will be treated.

ORM Timber Fund III (REIT) INC. c/o Black Fox Timber Management Group:

Son of Ed: THP #2-16-083. About 1,453 acres will be treated.

Oxbow Timber I LLC / Roseburg Resources Company:

South Trumpet: THP #2-17-001. About 367 acres will be treated.

Mills Ranch:

Dry Trapper: THP# 2-16-009. About 1,203 acres will be treated.

APPENDIX D: BEST MANAGEMENT PRACTICES

Best management practices (BMPs) were developed to comply with Section 208 of the Clean Water Act. Best Management Practices have been certified by the State Water Quality Resources Control Board and approved by the U.S. Environmental Protection Agency (EPA) as a way of protecting water quality from impacts stemming from non-point sources of pollution. These practices have been applied to forest activities and have been found to be effective in protecting water quality within the Klamath National Forest (Best Management Practices Effectiveness Monitoring Report, available at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5358328.pdf). Specifically, effective application of the R-5 USDA Forest Service BMPs has been found to maintain water quality that is in conformance with the Water Quality Objectives in the 2011 North Coast Regional Water Quality Control Board's Water Quality Control Plan (Basin Plan).

The following list of BMPs apply to the Craggy Project; the objective of each project-specific BMP, and the prescriptions and project design features developed to implement each, are identified below. For additional information on the BMPs and their objectives, see Water Quality Management for Forest System Lands in California (USDA 2000) and R-5 Water Quality Management Handbook (FSH 2509.22, Chapter 10). National Core BMPs are identified where appropriate and will also be implemented (USDA 2012c).

BMP 1.1 – Timber Sale Planning Process (National Core BMP Veg-1 Vegetation Management Planning): *Objective:* To incorporate water-quality and hydrologic considerations into the timber sale planning process. *Implementation:* A hydrologist, geologist, soil scientist, and fisheries biologist participated in the environmental analysis and documentation process and prescribed site-specific actions to avoid adverse effects to water quality.

BMP 1.2 – Timber Harvest Unit Design: *Objective:* To ensure that timber harvest unit design will secure favorable conditions of water quality and quantity, while maintaining desirable stream channel characteristics and watershed conditions. *Implementation:* The Interdisciplinary Team reviewed all units to select harvest methods appropriate to site conditions. Additionally, units were adjusted or removed to meet water quality protection goals.

BMP 1.3 – Determination of Surface Erosion Hazard for Timber Harvest Unit Design (National Core BMP Veg-2 Erosion Prevention and Control): *Objective:* To identify high-erosion hazard areas to adjust treatment measures and prevent downstream water-quality degradation. *Implementation:* Based on field review and site data (percent slope distribution, soil texture), the Forest Soil Scientist determined the surface erosion hazard rating for each treatment unit and prescribed logging systems and soil cover needs based on the erosion hazard rating. Selected management activities were designed to achieve predominately low erosion hazard ratings for Project implementation in treatment units.

BMP 1.4 – Use of Sale Area Maps and/or Project Maps for Designating Water Quality Protection Needs: *Objective:* To ensure recognition and protection of areas related to water-quality protection delineated on a sale-area map or a Project map. *Implementation:* Sale area

maps or project maps will include stream-courses, water drafting sites, legacy sediment sites and logging systems for units.

BMP 1.5 – Limiting the Operating Period of Timber Sale Activities: *Objective:* To ensure that the purchasers conduct their operations, including, erosion-control work, road maintenance, and so forth, in a timely manner, within the time specified in the timber sale contract. *Implementation:* Project design features developed to minimize negative effects include:

- *Watershed-1:* Ground-disturbing activities are proposed to take place during the normal operating season (NOS) that is defined as May 1 to October 31 and in dry periods outside the NOS, adhering to the Forest’s wet weather operation standards (USDA 2002), as approved by the Forest Service representative. When working in hydrologic riparian reserves: When there is a 30 percent chance of rain in the next 24 hours, a Forest Service representative will be on site to insure that winterization or erosion control procedures are implemented in a timely fashion and to initiate shutdown or resume operations. Operations will not resume until suitable weather, soil, and forecast conditions exist.

BMP 1.6 – Protecting Unstable Lands: *Objective:* To provide special treatment of unstable areas to avoid triggering mass slope failure with resultant erosion and sedimentation.

Implementation: Project watershed personnel conducted field reviews of all proposed harvest units and identified and documented unstable areas. Project design features developed to minimize negative effects include:

- *Watershed-9:* Tractors and mechanical harvesters will be excluded from active landslides, toe zones of dormant landslides and inner gorges unless reviewed and recommended by a geologist.
- *Watershed-12:* Cable corridors will be placed on the landscape as to minimize disturbance to unstable lands (such as inner gorges, active landslides and toe zones). The layout will avoid yarding logs up the axis of the features.

BMP 1.8 – Streamside Management Zone Designation (National Core BMPs Veg-3 Aquatic Management Zones and Plan-3 Aquatic Management Planning): *Objective:* To designate a zone along riparian areas, streams, and wetlands that will minimize potential for adverse effects from adjacent management activities. Management activities within these zones are designed to improve riparian values. *Implementation:* The Forest Plan designated Riparian Reserves and identified standards for activities within these designated areas that will be followed. Project design features developed to minimize negative effects include:

- *Watershed-11:* Place corridors for skyline-yarding outside hydrologic riparian reserves parallel to the stream channel unless field assessment by soil scientist and sale administrator determines that placing them within the riparian reserve will not substantially damage residual trees, soil, or fish. Full suspension will be required for any yarding across or over perennial and intermittent streams to avoid damage to stream banks.
- *Watershed-13:* Trees may be removed from riparian reserves if (1) trees must be removed to provide safe road passage or campground access and function; or (2) those trees would pose a substantial risk to the forest road drainage system integrity;

or (3) discussion with a fish biologist ensures that removal of these trees within riparian reserves is consistent with the Aquatic Conservation Strategy objectives.

BMP 1.9 – Determining Tractor Loggable Ground (National Core BMP Veg-4 Ground-Based Skidding and Yarding Operations): *Objective:* To minimize erosion and sedimentation resulting from ground disturbance of tractor logging systems. *Implementation:* Project design feature developed to minimize negative effects include:

- *Watershed-4:* Mechanized equipment will be restricted as follows (soil texture will be determined by the project soil scientist).
 1. To slopes less than 45 percent if soil texture is Loam or finer;
 2. To slopes less than 35 percent if soil texture is Sandy Loam or coarser;
 3. Mechanized equipment will be restricted to travelling generally in straight up and down patterns on slopes 35 to 45 percent and on steeper slopes for short portions (100 feet or less) regardless of texture when necessary;
 4. Where equipment will be operating on >45% slopes for more than just short stretches, a tether will be required;
 5. In stands where tractor skidding is used and, where practical, logs will be placed in bundles on slopes less than 35 percent;
 6. Skid trails that connect benches separated by short steep slopes (broken ground) can have minor portions (100 feet or less) of the skid trail on slopes greater than 35 percent.

BMP 1.10 – Tractor Skidding Design: *Objective:* By designing skidding patterns to best fit the terrain, the volume, velocity, concentration, and direction of runoff water can be controlled in a manner that will minimize erosion and sedimentation. *Implementation:* Project design features developed to minimize negative effects include:

- *Watershed-5:* Skidding equipment can operate in terraced plantations with slopes greater than 35 percent with the following restrictions: terraces will be used that are generally wide enough to accommodate harvesting and skidding equipment to limit increasing the cut and fill slopes on terraces. Skidding between terraces will be limited and locations of these skid trails will be flagged by the timber sale administrator with input from the project soil scientist.
- *Watershed-6:* No full bench skid trails will be constructed except in terraced plantations and then only on existing terraces. (Full bench skid trails have the entire skid trail cut into the hill slope).
- *Watershed-7:* Existing skyline corridors and ground-based skid trails will be reused whenever possible. Designation of new skid trails will be approved by Timber Sale Administrator. Use existing skid and swing trails instead of building new skid trails unless using existing skid trails will have greater negative effects than building new. Use no skid trails in areas (1) in which ground-based mechanical equipment is excluded; and (2) on highly erosive soils, unstable areas, wetlands, or wet meadows (excluding small springs and seeps).
- *Watershed-8:* Ground-based skidding and skyline cable yarding will require front-end suspension of logs on skid trails and corridors.

- *Watershed-15*: To minimize the concentration of surface runoff, slash or water bars will be applied to corridors, skid and swing trails where the ground cover is below 50 percent and where necessary to prevent runoff from entering the swing trails and stream channels. At project completion, permanent operating waterbars will be installed and/or repaired as necessary.
- *Watershed-27*: Take-offs of temporary roads, skid and swing trails that intersect roads will be obliterated or effectively blocked to vehicle access following unit treatment.

BMP 1.11 - Suspended Log Yarding in Timber Harvesting (National Core BMP Veg-5 Cable and Aerial Yarding Operations):

Objective: To protect the soil mantle from excessive disturbance; to maintain the integrity of the streamside management zone (SMZ) and other sensitive watershed areas, and to control erosion on cable corridors.

Implementation: Project design features developed to minimize negative effects include:

- *Watershed-11*: Place corridors for skyline-yarding outside hydrologic riparian reserves parallel to the stream channel unless field assessment by soil scientist and sale administrator determines that placing them within the riparian reserve will not substantially damage residual trees, soil, or fish. Full suspension will be required for any yarding across or over perennial and intermittent streams to avoid damage to stream banks.

BMP 1.12 – Log Landing Location (National Core BMP Veg-6 Landings):

Objective: To locate new landings or reuse old landings in such a way as to avoid watershed impacts and associated water-quality degradation. *Implementation:* Project design features developed to minimize negative effects include:

- *Watershed-20*: Existing landings will be used to the extent possible. Construct new landings outside both hydrologic and unstable-land riparian reserves and away from locations where sediment is likely to enter streams (areas that have a hydrologic connection to streams). If the existing landings are within 50 feet of slope distance to a stream channel or inner gorge they will not be used without consultation with the project hydrologist.

BMP 1.16 – Log Landing Erosion Control (National Core BMP Veg-6 Landings):

Objective: To reduce the impacts of erosion and subsequent sedimentation associated with log landings by use of mitigating measures. *Implementation:* Project design features developed to minimize negative effects include:

- *Watershed-21*: Once project activities are completed, re-establish natural runoff patterns on those landings used for the project (hydrologic stabilization) to protect water quality. Minimize sidecasting of material during maintenance, construction or reconstruction of landings. Use slash or straw to stabilize disturbed soil on fill slopes.

BMP 1.17 – Erosion Control on Skid Trails: *Objective:* To protect water quality by minimizing erosion and sedimentation derived from skid trails. *Implementation:* Project design features developed to minimize negative effects include:

- *Watershed-15*: To minimize the concentration of surface runoff, slash or water bars will be applied to corridors, skid and swing trails where the ground cover is below 50 percent and where necessary to prevent runoff from entering the swing trails and

stream channels. At project completion, permanent operating waterbars will be installed and/or repaired as necessary.

BMP 1.19 – Stream Course and Aquatic Protection (National Core BMPs Veg-3 Aquatic Management Zones, AqEco-1 Aquatic Ecosystem Improvement and Restoration Planning, and AqEco-2 Operations in Aquatic Ecosystems): *Objective:* To conduct management actions within these areas in a manner that maintains or improves riparian and aquatic values; to provide unobstructed passage of stormflows; to control sediment and other pollutants entering streamcourses; and to restore the natural course of any stream as soon as practicable, where diversion of the stream has resulted from timber management activities. *Implementation:* Project design features developed to minimize negative effects include:

- *Watershed-10:* Limit equipment disturbance within 20 feet on either side of swales by minimizing equipment crossings and avoiding running trails up the axis of swales. Swales are shallow ephemeral channels that do not meet the definition of a riparian reserve because they lack annual channel scour.
- *Watershed-14:* Trees directly rooted into the banks or otherwise and obviously integral to the stability of the channel bank will not be removed. Trees in the uplands will be directionally felled to protect stream banks.
- *Watershed-16:* Perennial streams, even if dry, will not be crossed by skid trails. Intermittent channels may be crossed when dry and at locations designated by the Forest Service.
- *Watershed-17:* Skid trails that cross intermittent streams or dry swales (i.e. depressions in the landscape that do not meet the definition for a designation as riparian reserve) will be restored before any storm (with reasonable chance of causing offsite sediment movement), or after use is complete. This generally consists of removing excess soil, reshaping and waterbarring former approaches, and spreading slash on the former crossing.
- *Watershed-18:* Dry intermittent streams may be crossed by a masticator at designated sites only after field review and approval by a Forest Service hydrologist. No perennial streams, even when dry, will be crossed.
- *Watershed-19:* Masticators will not operate within 150 feet of slope distance on perennial/and 100 feet slope distance on each side of intermittent streams, or the site potential tree height distance on each side of the stream, whichever is greatest (per Aquatic Conservation Strategy Objective 8). A masticator will not operate beyond the break in slope of any inner gorge. Consultation with the project fish biologist and/or hydrologist will occur to determine if any additional buffer width for masticator equipment is needed for a particular riparian reserve.
- *Watershed-29:* On roads treated for dust abatement, use erosion control methods such as watering only when necessary and applying non-excessive volumes to prevent any sedimentation of streams.

BMP 1.20 – Erosion Control Structure Maintenance: *Objective:* To ensure that constructed erosion-control structures are stabilized and working. *Implementation:* Erosion Control Measures will be maintained by the contractor for up to 1 year post-installation.

BMP 1.21 – Acceptance of Timber Sale Erosion Control Measures before Sale Closure: *Objective:* To ensure the adequacy of required erosion-control work on timber sales. *Implementation:* The Timber Sale Administrator will inspect the Erosion Control Measures for compliance with contract.

BMP 2.3 – Road Construction and Reconstruction (National Core BMP Road-3 Road Construction and Reconstruction): *Objective:* Minimize erosion and sediment delivery from roads during road construction or reconstruction, and their related activities. *Implementation:* Project design features developed to minimize negative effects include:

- *Watershed-23:* Use temporary roads on existing roadbeds instead of constructing new temporary roads except: (1) when temporary roads on existing roadbeds are located within stream-course riparian reserves (unless the only way to access the unit will be to use a stream crossing on an existing roadbed); or (2) when temporary roads on existing roadbeds are located on highly erosive soils, active landslides, wetlands or meadows (excluding small springs and seeps).
- *Watershed-24:* Improvements to existing roads in the project area will not over-steepen road cuts, will minimize sidecasting, and maintain the ditches and cross drains or any outslope of the roadway.
- *Watershed-28:* Temporary roads on existing road beds and new temporary roads will be blocked at the end of the normal or extended operating season when project activities cease due to wet weather conditions. All temporary roads will be hydrologically restored at project completion, which may include removal of culverts and fills at stream crossings, out-sloping of road surfaces, obliteration of road segments, and water barring or covering with slash.

BMP 2.4 – Road Maintenance and Operations (National Core BMP Road-4 Road Operations and Maintenance): *Objective:* To ensure water-quality protection by providing adequate and appropriate maintenance and by controlling road use and operations. *Implementation:* Project design features developed to minimize negative effects include:

- *Air Quality-1:* Haul routes will be watered to suppress dust when needed.
- *Watershed-25:* Spot rocking will be used as necessary if small and isolated portions of the road system do not adequately dry to allow haul when most of the road is capable of haul. Ensure haul over the newly rocked areas will not create adverse impacts, such as sediment moving offsite towards channels.

BMP 2.5 – Water Source Development and Utilization (National Core BMP WatUses-3 Administrative Water Developments): *Objective:* To supply water for road construction, maintenance, dust abatement, fire protection, and other management activities, while protecting and maintaining water quality. *Implementation:* Project design features developed to minimize negative effects include:

- *Watershed-30:* (1) Water drafting by more than one truck shall not occur simultaneously; (2) Pumping will be terminated before tank overflows occur; and (3)

Intakes, for trucks and tanks, shall be placed parallel to the flow of water and screened, with opening size consistent with the protection of aquatic species of interest.

- *Watershed-31*: When drafting from fish-bearing (anadromous) waters, use NOAA Fisheries Water Drafting Specifications including using of a NOAA approved fish screen to ensure specifications are met.
 - (1) When in habitat potentially occupied by Coho Salmon, intakes will be screened with 3/32" mesh for rounded or square openings, or 1/16 inch mesh for slotted openings.
 - (2) When in habitat potentially occupied by steelhead trout, intakes will be screened with 1/8" mesh size.
 - (3) Wetted surface area of the screen or fish-exclusion device shall be proportional to the pump rate to ensure that water velocity at the screen surface does not exceed 0.33 feet per second.
 - (4) Pumping rate will not exceed 350 gallons-per-minute (gpm) or 10 percent of the flow of the anadromous stream drafted from.
- *Watershed-32*: When drafting from fish-bearing (non-anadromous) waters
 - (1) Drafting rate should not exceed 350 gpm for streamflow greater than or equal to 4.0 cubic-feet-per-second (cfs).
 - (2) Below 4.0 cfs, drafting rates should not exceed 20 percent of surface flows.
 - (3) Drafting should cease when bypass surface flows drop below 1.5 cfs.
 - (4) Use screen sizes described by NOAA specifications for steelhead (1/8 inch mesh size) for rainbow trout.
- *Watershed-33*: When drafting from non-fish-bearing waters
 - (1) Drafting rate should not exceed 350 gallons per minute for stream flow greater than or equal to 2.0 cfs.
 - (2) Drafting rate should not exceed 50 percent of surface flow.
 - (3) Drafting should cease from when bypass surface flow drops below 10 gallons per minute.
- *Watershed-34*: Water drafting sites located in non-fish-bearing waters only may include minor instream modification, such as fine sediment removal and building of board/plastic dams, at the discretion of the project fish biologist or hydrologist. All boards and plastic will be removed after use. Approaches may be rocked. Water drafting sites located within fish-bearing stream segments may not be modified, except rocking the approach to prevent sedimentation.

BMP 2.8 – (National Core BMP Road-7 Stream Crossings): *Objective:* Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when constructing, reconstructing, or maintaining temporary and permanent waterbody crossings.

Implementation: Project design features developed to minimize negative effects include:

- *Watershed-26*: Existing low water crossings where forest transportation system roads cross perennial or intermittent streams will have temporary stream crossings installed for forest product removal, as approved by the project fisheries biologist. Installation and removal will be seasonally restricted as crossing will be installed during the operating season only and removed prior to end of the operating season of use. No project related non-passenger vehicles will cross the stream at these locations when/if

the temporary stream crossing is not in place. Project-related passenger vehicle use will be monitored and suspended if resource damage is likely to occur from continued use.

BMP 2.11 – Equipment Refueling and Servicing BMP 2.8 – (National Core BMP Road-10 Equipment Refueling and Servicing): *Objective:* Prevent fuels, lubricants, cleaners, and other harmful materials from discharging into nearby surface waters or infiltrating through soils to contaminate groundwater resources. *Implementation:* Project design features developed to minimize negative effects include:

- *Watershed 22:* Fueling and servicing of vehicles used for proposed activities will be done outside of hydrologic riparian reserve except at designated landings in locations where most disconnected from water resources.

A spill containment kit will be in place where refueling and servicing take place. Report spills and initiate appropriate clean-up action in accordance with applicable state and federal laws, rules and regulations. The forest hazardous materials coordinator's name and phone number shall be available to Forest Service personnel who administer or manage activities utilizing petroleum-powered equipment.

In the occurrence of a spill which may affect listed aquatic species, NOAA Fisheries will be notified for emergency consultation.

BMP 2.13 – Erosion Control Plan (National Core BMPs Fac-2 Facility Construction and Stormwater Control, Road-3 Road Construction and Reconstruction, Road-4 Road Operations and Maintenance, and Road-7 Stream Crossings): *Objective:* Effectively limit and mitigate erosion and sedimentation from any ground-disturbing activities, through planning prior to commencement of project activity, and through project management and administration during project implementation. *Implementation:* An Erosion Control Plan will be followed.

BMP 5.2 - Slope Limitations for Mechanical Equipment Operation (National Core BMPs Veg-2 Erosion Prevention and Control, Veg-4 Ground-Based Skidding and Yarding Operations, and Veg-8 Mechanical Site Treatment): *Objective:* To reduce gully and sheet erosion and associated sediment production by limiting tractor use. *Implementation:* See BMP 1.9 (Project Design Feature Watershed-4) for slope limitations on mechanical equipment.

BMP 5.5 - Disposal of Organic Debris: *Objective:* To prevent gully and surface erosion with associated reduction in sediment production and turbidity during and after treatment. *Implementation:* Project design features developed to minimize negative effects include:

- *Watershed-2:* Post treatment soil cover will range from 50-80 percent depending on slope steepness, soil texture, and fuel reduction treatments.
- *Watershed-3:* Maintain existing coarse woody debris by having ground-based equipment avoid the larger diameter woody debris as much as practical.

BMP 5.6 - Soil Moisture Limitations for Mechanical Equipment Operations: *Objective:* To prevent compaction, rutting, and gullyng, with resultant sediment production and

turbidity. *Implementation:* See BMP 1.5 (Project Design Feature Watershed-1) for Wet Weather Operating Standards.

BMP 6.1 – Fire and Fuel Management Activities (National Core BMP Fire-1 Wildland Fire Management Planning): *Objective:* To reduce public and private losses and environmental impacts which result from wildfires and/or subsequent flooding and erosion by reducing or managing the frequency, intensity, and extent of wildfire. *Implementation:* The District Fuel/Fire department helped determine acceptable levels of slash to retain on the site following harvest activities and also to identify areas and methods to remove standing slash of a sub merchantable size, that otherwise would create an unacceptable fire risk.

BMP 6.2 – Consideration of Water Quality in Formulating Fire Prescriptions (National Core BMP Fire-2 Use of Prescribed Fire): *Objective:* To provide for water-quality protection while achieving the management objectives through the use of prescribed fire. *Implementation:* See BMP 5.5 (Project Design Feature Watershed-2).

BMP 6.3 – Protection of Water Quality from Prescribed Burning Effects (National Core BMP Fire-2 Use of Prescribed Fire): *Objective:* To maintain soil productivity; minimize erosion; and minimize ash, sediment, nutrients, and debris from entering water bodies. *Implementation:* Project design features developed to minimize negative effects include:

- *Watershed-35:* Ignition of underburns will generally not occur in riparian reserves, except to minimize the potential for burning material to roll down into a riparian reserve that would increase the potential for moderate or high intensity burns. Ignition will generally occur outside of riparian reserves (in upland areas) to avoid possibility of drip torch fuel entering stream courses. Fire will be allowed to back into riparian reserves to allow for a low intensity fire.
- *Watershed-36:* Restrictions for hand pile construction: (1) Place in a checkerboard pattern whenever possible (not one pile directly above another); (2) Hand piles must be small in size, 6 feet or less in diameter; (3) No hand piles within 15 feet of any perennial or intermittent stream channel; and (4) Between 15 and 30 feet, hand piles may be constructed if the following conditions exist: (a) not granitic soils, (b) slope is less than 35 percent, or (c) ground cover is greater than 50 percent. If the condition cannot be met, then slash should be lopped and scattered.
- *Watershed-37:* Burning hand piles within Riparian Reserves (see Watershed-36 for hand pile construction description): (1) If perennial streams are greater than 1 foot in width, only hand piles greater than 30 feet from the channel may be burned; (2) If intermittent and small (less than 1 foot in width) perennial streams, hand piles greater than 15 feet from the channel may be burned.
- *Watershed-38:* For underburning, construction of handlines in riparian reserves closer than 25 feet to a watercourse shall be avoided where practical. Handline construction in riparian vegetation shall be avoided where practical. Handlines will be mitigated (waterbarred and covered with organic material) immediately following prescribed burning, when safe to do so.
- *Watershed-39:* When underburning in riparian reserves, at least 90 percent of the large woody debris will not be consumed, both standing and on the ground.

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APPENDIX E: LEGACY SEDIMENT SITE INVENTORY

Table E-1: Legacy Sediment Site Inventory Chart

Note: Gray highlight = hydrologic stabilization, and **Bold*** = potential stormproofing

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
45N04X - 0.52	344	34 - Medium-High	Pipe function and fill in place. But has undersized culvert and diversion potential.	Replace pipe and install critical dip.
45N04X - 0.93	121	23- Medium-Low	Ephemeral swale crossing. Some fill eroded and active erosion.	Remove fill.
45N04X - 1.07	367	27- Medium-Low	Ephemeral swale diverted by road 50 feet. Slight scour on old road surface where flow exits. Outboard fill eroded but stable.	Remove fill and remove diversion potential.
45N08X - 0.10	200	35- Medium-High	Insloped road design has propagated a chronic gully for 100 feet. Could lose whole road segment in the long term. Berm exists on outboard side.	Stormproof road, provide outslope for proper drainage.
45N08X - 0.22	24	14- Low	Small swale crosses. Active erosion.	Install critical dip.
45N08X - 0.48	200	35- Medium-High	Insloped road design has propagated a chronic gully for 100 feet. Could lose whole road segment in the long term. Berm exists on outboard side.	Stormproof road, provide outslope for proper drainage.
45N08X - 0.58	200	35- Medium-High	Insloped road design has propagated a chronic gully for 100 feet. Could lose whole road segment in the long term. Berm exists on outboard side.	Stormproof road, provide outslope for proper drainage.
45N08X.1 - 0.08	100	25- Medium-Low	Ephemeral stream crossing unauthorized route. Active erosion. Fill.	Hydrologically stabilize and remove fill.
45N08X.1 - 0.10	203	19- Medium-Low	Unauthorized route with trees growing in fill. Ephemeral stream crosses without a culvert. Portion of fill has been removed from runoff with alluvial deposits. Rest of fill still in place.	Hydrologically stabilize and remove fill.
45N08X.1 - 0.26	213	25- Medium-Low	Ephemeral stream crossing old unauthorized route. Portion of fill removed by chronic erosion. Some fill left.	Hydrologically stabilize and remove fill.
45N08X.1 - 0.35	200	20- Medium-Low	Ephemeral stream crosses without culvert. Portion of fill removed, but fill still in place.	Hydrologically stabilize and remove fill.
45N08X.1 - 0.42	284	19- Medium-Low	Ephemeral stream without culvert. Fill still in place though some has been eroded.	Hydrologically stabilize and remove fill.
45N08X.1 - 0.52	175	19- Medium-Low	Unauthorized route mostly blown out at this stream crossing. About 1/2 fill remaining. Still some active erosion.	Hydrologically stabilize and remove fill.
45N08X.1 - 0.62	100	25- Medium-Low	Unauthorized route captures runoff in several locations causing fill failures and outboard fill gully.	Hydrologically stabilize.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
45N08X.1 - 0.78	225	20-Medium-Low	Spring flow diverted. Stable currently, but could saturate fill and cause failure.	Hydrologically stabilize. Provide proper drainage for fill.
45N08X.1 - 0.82	168	26-Medium-Low	Bed of unauthorized route is saturated by springs with active diversion of ephemeral stream crossing above. Route has sliver fills in headwall of steep intermittent stream.	Hydrologically stabilize. Remove fill. Rebuild stream and spring drainage.
45N08X.1 - 0.83	224	26-Medium-Low	Intermittent stream with most fill remaining. No active erosion.	Hydrologically stabilize.
45N28	30	15- Low	Rill on road surface over 200 feet. Caused by insloped road design.	Outslope road surface to provide proper drainage for road surface runoff.
45N28	10	15- Low	Rill on road surface over 200 feet. Caused by insloped road design.	Outslope road surface to provide proper drainage for road surface runoff.
45N28	10	15- Low	Rill on road surface over 200 feet. Caused by insloped road design.	Outslope road surface to provide proper drainage for road surface runoff.
45N28	10	15- Low	Rill on road surface over 200 feet. Caused by insloped road design.	Outslope road surface to provide proper drainage for road surface runoff.
45N28	10	15- Low	Rill on road surface over 200 feet. Caused by insloped road design.	Outslope road surface to provide proper drainage for road surface runoff.
45N28	10	15- Low	Rill on road surface over 200 feet. Caused by insloped road design.	Outslope road surface to provide proper drainage for road surface runoff.
45N28	10	15- Low	Rill on road surface over 200 feet. Caused by insloped road design.	Outslope road surface to provide proper drainage for road surface runoff.
45N33X - 0.05	10	15- Low	Intermittent stream crossing in ford. Not armored, so small road surface scouring.	Armor ford.
45N33X - 0.22	10	15- Low	Intermittent stream crossing in ford. Not armored, so small road surface scouring.	Armor ford.
45N39 - 2.66*	4588	41-Medium-High	Intermittent stream crossing with large fill and diversion potential.	Reduce fill and eliminate diversion potential.
45N39 - 2.73*	4575	42-Medium-High	Intermittent stream crossing with large fill and diversion potential.	Reduce fill and eliminate diversion potential.
45N39 - 3.91*	869	31-Medium-High	Diversion potential only.	Construct dip.
45N39 - 5.33*	4118	41-Medium-High	Stream flows into inboard ditch, crosses in ditch relief culvert 50' below crossing. Pipe is obviously undercut. Diversion potential.	Create proper crossing location for stream including a fill reduction and critical dip.
45N39 - 5.35*	27	20-Medium-Low	Cross drain with diversion potential.	Construct dip.
45N41 - 0.28*	84	11- Low	Ephemeral stream crossing in ford. Gully in road.	Armor.
45N41 - 0.69*	151	16- Low	Small ephemeral channel crossings in unarmored ford. Slight outboard fill erosion.	Armor.
45N41 - 0.81*	853	26-Medium-Low	Small ephemeral channel. No active erosion. Fully vegetated. Not much fill at risk, but still could be chronic source.	Armor.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
45N41 - 0.90*	266	22-Medium-Low	Intermittent stream crossing in ford. Small head-cut in outboard fill.	Armor ford.
45N41 - 0.92*	74	20-Medium-Low	Diversion of swale 10' above site, exits road. Small rill in road surface.	Armor rill.
45N41 - 0.96*	30	25-Medium-Low	Road surface drainage exits at point creating outboard fill gully. Road insloped around turn.	Outslope road surface.
45N41 - 1.10*	100	30-Medium-Low	Ephemeral stream crossing in ford. Outboard erosion. Whole fill in danger.	Install proper pipe crossing or armored ford. Reduce fill.
45N41 - 1.13*	182	24-Medium-Low	Swale crossing in ford. Small rill on road surface.	Armor.
45N41 - 1.14*	108	24-Medium-Low	Rill on road.	Outslope.
45N41 - 1.21*	20	20-Medium-Low	Rill on road	Outslope.
45N41 - 1.25*	40	20-Medium-Low	Rill on road for 300 feet. Due to road surface runoff captured from insloped road design.	Outslope.
45N41 - 1.35*	186	17- Low	Ephemeral stream crossing in ford. Active outboard fill erosion.	Armor crossing.
45N41 - 1.45*	287	18-Medium-Low	Small ephemeral stream crossing in ford. No erosion currently.	Armor crossing.
45N41 - 1.72*	74	13- Low	Rill on road surface from insloped road design.	Outslope road.
45N41 - 1.81*	155	17- Low	Rill on road surface from insloped road design.	Outslope road.
45N41 - 1.91*	197	17- Low	Ephemeral stream crossing in ford. Small gully in road surface and outboard fill.	Armor ford crossing.
45N41 - 2.00*	165	22-Medium-Low	Ephemeral stream crossing in ford. Small gully in road surface and outboard fill.	Armor
45N41 - 2.02*	77	15- Low	Ephemeral stream crossing in ford. Small gully in road surface and outboard fill.	Armor
45N41 - 2.15*	167	19-Medium-Low	Ephemeral stream crossing in ford. Small gully in road surface and outboard fill.	Armor
45N41 - 2.35*	185	19-Medium-Low	Ephemeral stream crossing in ford. Small gully in road surface and outboard fill.	Armor
45N41 - 2.43*	10	15- Low	Rill on road surface from diverted swale crossing above at 2.46.	Outslope road surface.
45N41 - 2.46*	108	25-Medium-Low	Diverting to 45N41 - 2.43.	Create dip. Armor.
45N42 - 0.05	41	19-Medium-Low	Medium sized intermittent stream cutting through outboard fill. Not a lot of fill in crossing.	Remove fill or armor.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
45N42 - 0.28	193	23-Medium-Low	Ephemeral stream crossing. Slow stable cutting through outboard fill.	Stormproof or armor.
45N42 - 0.58	253	35-Medium-High	Ephemeral stream slowly cutting through outboard fill. Active erosion in crossing. Large fill.	Stormproof or armor.
45N42 - 1.00	683	40-Medium-High	Ephemeral stream slowly cutting through outboard fill. Active erosion in crossing. Large fill.	Stormproof or armor.
45N42 - 1.20	107	18-Medium-Low	Intermittent stream cutting through fill slowly. Appears stable but a lot of fill left.	Stormproof or armor.
45N42 - 1.25	276	17- Low	Intermittent stream cutting through fill. Appears stable but a lot of fill.	Stormproof or armor.
45N42 - 1.26	126	17- Low	Intermittent stream has blown through fill. Head-cut in creek above moving slowly upstream. Not a lot of fill in crossing. Conifers in road bed.	Stormproof.
45N43 - 0.08	30	16- Low	Road/off-highway vehicle trail route crosses swale: runoff is being routed toward over-steepened stream banks.	Engineering fix has not been proposed as of yet.
45N43 - 0.14	566	30-Medium-Low	Lots of fill in intermittent stream, but no defined channel or diversion potential and no active erosion.	Low priority.
45N47 - 0.69*	525	43-Medium-High	Pipe functional with no field evidence of oversized pipe, but diversion potential.	Construct dip.
45N47 - 0.85*	569	34-Medium-High	Pipe functional, but diversion potential.	Construct dip.
45N47 - 1.19*	310	42-Medium-High	Functional stable pipe with diversion potential, not a lot of field evidence of undersized pipe, but very undercut by calculations.	Install Q100 pipe and critical dip.
45N47 - 1.34*	372	38-Medium-High	Two pipes currently. Primary pipe is 24", very overloaded. 48" pipe higher in fill. Slight diversion potential.	Replace pipes and install critical dip.
45N53 - 0.21	149	23-Medium-Low	Rocky ford crossing small swale. Small rill in road surface.	Armor ford.
45N53 - 0.40	108	20-Medium-Low	Rocky ford crossing of small intermittent stream. Small rill in road surface.	Armor crossing.
45N53 - 0.50	145	20-Medium-Low	Rill on road 100' x 1' x 2'.	Outslope road segment.
45N53 - 0.57	78	16- Low	Rill in road draining to dip for ephemeral stream crossing (400').	Outslope to hydrologically disconnect.
45N53 - 0.72	196	25-Medium-Low	Intermittent stream crossing in dip not deep enough. Diverts down road 200'. Also, rill in road above contributing to crossing.	Deepen/armor crossing and outslope.
45N53 - 0.83	144	26-Medium-Low	Rill on road 100' from swale crossing.	Deepen dip, armor. Outslope.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
45N53 - 0.84	96	20-Medium-Low	Existing dip nearly overwhelmed with sediment and flow.	Deepen and armor dip.
45N53 - 0.90	6	15- Low	Rill in road 150 feet, exits in rolling dip at point. Dip filled with sediment.	Outslope and reestablishes dip.
45N53 - 1.15	265	35-Medium-High	Intermittent stream crossing in ford. Rill on road surface. Diversion potential exists in large event.	Install armored ford crossing.
45N53 - 1.98	41	35-Medium-High	Intermittent stream crossing in ford. Gully forming as stream cuts through fill.	Armor ford, stormproof, or install pipe.
45N53 - 2.16	50	25-Medium-Low	Fill in crossing but no flow, ephemeral drainage.	Engineering fix has not been proposed as of yet.
45N53 - 2.60	100	25-Medium-Low	McKinley Mine, old adit producing flow, flow diverting down old rail cart trail, ponds, then runs down steep cutbank and across road. Saturating road fill but no active erosion.	Engineering fix has not been proposed as of yet.
45N88 - 1.81	136	24-Medium-Low	Road used by off-highway vehicles only but drivable. Ephemeral stream crossing with diversion potential. Some fill already gone.	Construct critical dip.
45N88.1 - 0.44	35	20-Medium-Low	Small 8" culvert has plugged inlet. Raw eroding fill slopes from unauthorized route surface runoff and active overtopping. Channel is incising and unstable.	Construct an armored ford, outslope.
45N88.1 - 0.66	80	14- Low	Small ephemeral stream crossing with small erosion.	Remove fill, hydrologically stabilize.
45N88.1 - 0.83	43	18-Medium-Low	Intermittent stream crossing with some active erosion.	Hydrologically stabilize.
45N88.1 - 0.92	47	20-Medium-Low	Large old ditch crossing off-highway vehicle trail. Some erosion in ditch.	Remove fill, hydrologically stabilize.
45N88.1 - 1.00	10	15- Low	Gully on unauthorized route surface from off-highway vehicle use.	Hydrologically stabilize unauthorized route.
45N88.1 - 1.02	29	20-Medium-Low	Crossing is undersized and has diversion potential; though, very low flow.	Remove fill, hydrologically stabilize.
45N88.1 - 1.05	30	25-Medium-Low	Rills on unauthorized route surface due to insloped road design.	Hydrologically stabilize and outslope.
45N88.1 - 1.28	56	13- Low	Small creek crossing cutting through fill (half gone)	Remove fill, hydrologically stabilize.
45N88.1 - 1.39	48	20-Medium-Low	Very low flow ephemeral stream crossing with fill remaining.	Remove fill, hydrologically stabilize.
45N88.1 - 1.40	58	18- Low	Very low flow intermittent stream with fill remaining.	Remove fill, hydrologically stabilize.
45N88.1 - 1.48	41	35-Medium-High	Larger intermittent stream crossing. Diversion potential, early active diversion. Active cutting through fill, though populated with trees.	Remove fill, hydrologically stabilize.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
45N88.1 - 1.55	452	35-Medium-High	Channel cutting through fill.	Remove fill, hydrologically stabilize.
45N88.1 C - 0.08	84	20-Medium-Low	Intermittent drainage with diversion potential and small head-cut, but actively eroding through fill. Only 20 cubic yards left.	Remove fill, hydrologically stabilize.
45N88.1 C - 0.09	17	12- Low	Gully on unauthorized route bed from ephemeral crossing.	Remove fill, hydrologically stabilize.
45N88.2 - 2.52	64	20-Medium-Low	Intermittent stream diverts 500' forming rill. Actively eroding fill.	Remove fill or create pipe crossing and outslope.
45N88.2 - 2.55	239	23-Medium-Low	Intermittent stream crossing with only 10 cubic yards of fill in crossing with slight erosion. Also, sediment from creek being deposited on trail. Diversion potential.	Remove fill, hydrologically stabilize.
45N88.2 - 2.61	30	15- Low	Diverted intermittent stream creating rill on trail.	Outslope, hydrologically stabilize. Ensure stream doesn't divert.
45N88.3 - 0.50	63	35-Medium-High	Stream crossing has incised through fill with raw fill slopes remaining.	Pull back fill and stabilize stream channel.
45N88.3 - 0.66	170	35-Medium-High	Ephemeral stream crossing has incised through fill with raw fill slopes remaining.	Remove fill, hydrologically stabilize.
45N88.3 - 0.78	176	35-Medium-High	Ephemeral stream crossing has incised through fill with active erosion.	Remove fill, hydrologically stabilize.
46N16 - 0.47	500	35-Medium-High	Large fill in intermittent stream. Pipe inlet half crushed, evidence of recent active overtopping and diversion.	Replace pipe and install dip.
46N16 - 0.56	500	30-Medium-Low	24" culvert not in road sediment site inventory. Rust line low. No field evidence of undersized pipe, functional pipe; but diversion potential.	Install critical dip.
46N16 - 1.24	11	15- Low	Rill on road surface exits before switchback causing gully on outboard fill and rill on road below.	Outslope to cut off road runoff causing gully.
46N16 - 1.50	10	15- Low	Ephemeral channel from road above causing rill on road.	Armor dip.
46N16.1	100	35-Medium-High	Old dozer line created an unofficial user created unauthorized route up nose of ridge. Gully and rill erosion.	Block off-highway vehicle use on unauthorized route to allow vegetation to reestablish and stabilize erosion. Install water bars for rehabilitation.
46N16A - 0.62	60	20-Medium-Low	Overland flow concentrated in outboard rut and causing rut to deepen into a gully.	Outslope.
46N18 - 1.78	25	21-Medium-Low	Rocky ford crossing of perennial stream. Not well armored. Currently stable, but large event could cause erosion.	Armor ford crossing.
46N22 - 0.28*	561	31-Medium-High	Functional crossing and pipe but diversion potential.	Install critical dip.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
46N22 - 0.66*	30	15- Low	Small cut bank gully head-cutting through granitic soil above. Rill on road.	Stabilize.
46N22 - 1.01*	613	35- Medium-High	Culvert not undersized. Not bad diversion potential either.	Could use critical dip.
46N22 - 1.49*	754	30- Medium-Low	Inlet pool of culvert totally filled in by aggraded material. Whole fill is intact but subsurface flow active under road. Pipe is an undersized culvert.	Replace culvert.
46N22 - 2.18*	318	37- Medium-High	Culvert inlet half blocked with sediment. Also, entire ditch line is filled and chronic rill erosion on whole road segment.	Provide maintenance or outslope road segment.
46N22 - 2.95*	647	35- Medium-High	Functional pipe but diversion potential.	Install dip.
46N22 - 3.52*	533	41- Medium-High	Pipe functional with no field evidence of undersized pipe.	Install critical dip and fill reduction if possible. Install inlet apron to increase capacity.
46N22 - 3.69*	30	25- Medium-Low	Cut bank land slide, lots of fill on road that is sloughing down steep inner gorge into creek.	Try to stabilize cut slope.
46N22 - 3.75*	707	41- Medium-High	Undersized culvert with diversion potential as well. Though no field evidence of undersized pipe, calculations are enough to warrant replacement.	Replace culvert and install critical dip.
46N22 - 3.84*	340	39- Medium-High	Pipe okay but there's diversion potential.	Install critical dip.
46N22 - 4.07*	300	37- Medium-High	Functional intermittent stream crossing with slight diversion potential. No field evidence of undersized pipe, but calculations indicate undersized culvert.	Install critical dip and inlet apron if pipe is still in good shape. If not, replace pipe as well.
46N22 - 4.25*	852	40- Medium-High	Small intermittent stream crossing in old pipe that is buried. Appears that subsurface flow is active under the road. Diversion potential as well.	Replace pipe and install dip.
46N22 - 5.09	301	28- Medium-Low	Small intermittent stream likely undersized culvert. Some field evidence of undersized pipe.	Replace pipe and install dip.
46N22 - 6.30	350	39- Medium-High	Pipe very undersized on large intermittent stream. No current erosion in crossing. Pipe has a lot of field evidence of being undersized.	Reduce fill over crossing, replace pipe, install dip.
46N22 - 6.35	416	44- Medium-High	Intermittent stream crossing with diversion potential. Pipe very undersized by calculations, but not much field evidence of undersized pipe. Rust at about at 1/3 capacity.	Replace pipe and install critical dip.
46N22 - 6.43	45	35- Medium-High	Small ephemeral stream crossing with functional pipe but diversion potential.	Install critical dip.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
46N22 - 7.05	403	30-Medium-Low	Undersized pipe with crushed inlet. No diversion potential.	Replace pipe.
46N22.5 - 0.06	10	15- Low	Low energy flow off 46N22 as enters unauthorized route, runs down route creating rill, exits in two dips.	Hydrologically stabilize, outslope.
46N22.5 - 0.16	10	15- Low	Rill in unauthorized route.	Hydrologically stabilize.
46N22.7 - 0.10	10	15- Low	Runoff collects on landing, exits landing creating small gully.	Hydrologically stabilize.
46N24	15	15- Low	Rill on road surface.	Outslope.
46N24	15	15- Low	Rill on road surface.	Outslope.
46N24	15	15- Low	Rill on road surface.	Outslope.
46N24	15	15- Low	Rill on road surface.	Outslope.
46N24 - 0.19*	30	20-Medium-Low	Unauthorized route runoff causing gully on 46N24 road below.	Hydrologically stabilize unauthorized route/block.
46N24 - 0.42*	20	15- Low	Rill on road surface from insloped trail design.	Outslope.
46N24 - 0.47*	10	15- Low	Rill on road surface from insloped road design (150x2x2).	Outslope.
46N24 - 0.56*	20	15- Low	Rill on road surface from insloped road design (300 x 1 x 2).	Outslope.
46N24 - 0.62*	20	15- Low	Rill on road surface 100 feet.	Outslope.
46N24 - 0.70*	20	15- Low	Rill in dip.	Armor.
46N24 - 0.78*	20	15- Low	Rill on road surface.	Outslope.
46N24 - 0.95*	15	15- Low	Rill on road surface (500'x1'x2').	Outslope.
46N24 - 1.23*	124	40-Medium-High	Intermittent stream crossing. Pipe very undersized. Slight diversion potential as well which was active when inventoried.	Install larger pipe or adequate ford.
46N24 - 1.53*	10	15- Low	Rill on road surface.	Outslope.
46N24 - 1.56*	19	15- Low	Rill on road surface 500 feet.	Outslope.
46N24 - 1.70*	41	13- Low	Rill on road surface 50 feet.	Outslope.
46N24 - 1.74*	76	20-Medium-Low	Ephemeral stream crossing forming a gully.	Armor ford crossing.
46N24 - 1.78*	40	15- Low	Rill on road surface with through-cut trail section. Rill 500 feet long, 2' D X 2' W.	Provide functional drainage.
46N24.4 - 0.54	31	12- Low	Rill on trail surface from intermittent stream crossing.	Armor.
46N24.4 - 0.62	125	18-Medium-Low	Rill on trail surface from intermittent stream crossing.	Armor.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
46N24.4 - 0.64	157	22-Medium-Low	Rill on trail surface from intermittent stream crossing.	Armor.
46N24.4 - 0.72	167	17- Low	Rill on trail surface from intermittent stream crossing.	Armor.
46N24.4 - 0.85	188	18-Medium-Low	Rill on trail surface from intermittent stream crossing.	Armor.
46N24.4 - 1.02	60	15- Low	Ponding on intermittent stream crossing. Some active erosion.	Outslope and armor.
46N24.4 - 1.12	45	18-Medium-Low	Ponding on intermittent stream crossing. Some erosion.	Outslope and armor.
46N24.4 - 1.30	86	16- Low	Ponding on intermittent stream crossing. Some erosion.	Outslope and armor.
46N24.4 - 1.63	50	17- Low	Intermittent stream crossing with some active erosion.	Armor.
46N24.4 - 1.71	30	16- Low	Lots of fill in crossing but trees stabilizing fill, some chronic surface erosion of fill.	Armor.
46N24.5 - 0.15	23	19-Medium-Low	Small intermittent stream crossing trail. Some erosion of fill.	Armor.
46N24.5 - 0.25	96	12- Low	Ephemeral stream crossing in ford with some erosion of fill.	Armor.
46N24.5 - 0.37	189	19-Medium-Low	Ephemeral stream crossing in ford with some erosion of fill.	Armor.
46N24.5 - 0.57	47	15- Low	Intermittent stream crossing in ford with some erosion of fill.	Armor.
46N24.6 - 0.10	276	35-Medium-High	Intermittent stream crossing in ford. No proper drainage structure. Diversion potential.	Install pipe or armored ford.
46N24.6 - 0.12	20	15- Low	Rills on trail surface 400' x 2'.	Outslope.
46N24.6 - 0.60	88	25-Medium-Low	Ephemeral stream crossing in dip. Slight erosion. Some natural armor.	Add more armor.
46N24.6 - 0.75	41	30-Medium-Low	Undersized pipe functional, slight diversion potential over small perennial stream. Not much fill in crossing.	Replace pipe install critical dip.
46N30 - 0.08	20	15- Low	Rill on road 300 feet.	Outslope.
46N30 - 0.19	70	20-Medium-Low	Rill on road 300' x 3' x 1'. Sediment going directly into intermittent channel.	Outslope, provide proper drainage.
46N30 - 0.35	20	15- Low	Rill on road 300 feet.	Outslope.
7H002.5 - 0.01	100	30-Medium-Low	Intermittent stream crosses on unauthorized route. Culvert overloaded and actively overtopping. No diversion potential.	Hydrologically stabilize culvert, establish natural stream dimensions. Remove all fill.
7H01.3 - 0.39	70	25-Medium-Low	Rill along unauthorized route surface for 950 feet.	Hydrologically stabilize.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
7J001.3 - 0.13	508	45-Medium-High	Large flattened landing-like area next to perennial stream. Intermittent stream flows through center of feature before entering perennial stream. Active erosion and gully.	Hydrologically stabilize and remove fill. Reestablish natural drainage and channel characteristics.
7J001.7 - 0.01	40	30-Medium-Low	Gully on unauthorized route bed (50'x5'x5').	Hydrologically stabilize unauthorized route to restore drainage.
7J001.7 - 0.11	40	35-Medium-High	Old dysfunctional culvert crossing intermittent stream. Garbage everywhere. Fill still in crossing.	Remove pipe, reestablish natural stream characteristics.
7J001.7 - 0.16	30	24-Medium-Low	Fill and garbage in stream channel. Active erosion of fill.	Hydrologically stabilize.
7J001.7 - 0.17	300	45-Medium-High	Stream diverted around large earthen dam in floodplain and active channel. Active erosion.	Above dam, seems to be large filled in sediment pond that is revegetating. May be unfeasible to remove dam. So possibly just armor the diverted stream channel to slow erosion.
7J001.99 A - 0.09	15	15- Low	Slow erosion through fill in intermittent stream channel.	Armor or pull back fill.
7J001.99 A - 0.31	57	17- Low	Slow erosion through fill by intermittent stream.	Remove fill.
7J002.1 - 0.20	10	15- Low	Ford crossing small intermittent stream on unauthorized route. Outboard fill with active erosion.	Hydrologically stabilize, remove fill.
7J002.1 - 0.40	30	35-Medium-High	Significant rutted gully on unauthorized route surface.	Hydrologically stabilize, remove fill.
7J002.3 - 0.38	100	25-Medium-Low	24" culvert crossing intermittent stream channel. Pipe is functional, with no field evidence of undersized pipe. Most likely not undersized culvert, and no diversion potential.	Remove pipe, hydrologically stabilize crossing.
7J002.4 - 0.05	142	25-Medium-Low	Small perennial stream crossing in functional 36" culvert with low rust line but evidence of high scour. Probably not an undersized culvert, but still on unauthorized route.	Remove pipe, hydrologically stabilize crossing.
7J01.3 - 0.05	155	35-Medium-High	Rill runs into gully, enters county road inboard ditch. Gully is 700 feet long, 3 x 2 feet deep/wide.	Remove insloped road design. Hydrologically stabilize take off. Recontour.
7J01.3 - 0.49	60	35-Medium-High	Ford crossing intermittent stream with active diversion 30'. No erosion yet. Fill in crossing.	Remove fill, hydrologically stabilize.
7J031.10 - 0.19	50	21-Medium-Low	Gully forming in dry floodplain terrace from flow off county road above.	Remove flow from county road.
7J031.11 - 0.16	70	25-Medium-Low	Long, shallow rill on unauthorized route 800' long.	Outslope, hydrologically stabilize unauthorized route.
7J031.11 - 0.28	100	30-Medium-Low	Small earthen damn with small pipe. 10 cubic yards gone over pipe but 100 cubic yards remain.	Remove fill, hydrologically stabilize dam.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
7J031.11 - 0.47	482	33-Medium-High	Erosion of fill. Lots of fill in channel. Some active erosion.	Remove fill, hydrologically stabilize.
7J031.11 - 0.49	1200	40-Medium-High	Lots of fill in channel with active head-cut moving through fill.	Remove fill, hydrologically stabilize.
7J031.11 - 0.54	555	45-Medium-High	Earthen dam on intermittent channel. Dam is still fully in-tact and has a functional but very old culvert near the top developing a gully on unauthorized route. Banks raw below. Dam size (50' x 15' x 20').	Remove dam and culvert, pull back fill and stabilize stream channel.
7J031.11 - 0.61	390	45-Medium-High	Flow from dam cutting through road fill in inner gorge of stream.	Remove fill, hydrologically stabilize.
7J031.11 - 0.64	30	28-Medium-Low	Road fill in inner gorge of high energy intermittent stream. Diversion potential. Much more fill lost if diverted.	Remove fill, hydrologically stabilize.
7J031.9 - 0.18	200	33-Medium-High	Intermittent stream overtops unauthorized route, diverts 30', exits route. Active erosion at exit.	Hydrologically stabilize/outslope.
7J031.9 - 0.28	412	33-Medium-High	Flow on unauthorized route exits in dip, creating outboard fill gully.	Remove fill, hydrologically stabilize.
8J002.3 - 1	40	35-Medium-High	Intermittent stream crossing old mining road (unauthorized route). Active diversion 20 feet and gully where flow exits route. Old 18" pipe present but half filled with sediment.	Hydrologically stabilize pipe and remove all fill. Reestablish natural channel characteristics.
8J002.3 - 2	10	15- Low	Rill on unauthorized route surface.	Improve drainage.
8J002.3 - 3	50	20-Medium-Low	Gully on unauthorized route surface.	Hydrologically stabilize and restore natural drainage.
8J002.3 - 4	60	25-Medium-Low	Gullies from unknown source.	Engineering fix has not been proposed as of yet.
8J002.3 - 5	500	45-Medium-High	Several gullies converge on eroding ephemeral swale. Probably mine related. Appears to be old route crossing. Lots of exposed actively eroding decomposed granite soil. 100-500 cubic yards eroded already.	Engineering fix has not been proposed as of yet.
8J002.3 - 6	10	15- Low	Unauthorized route goes into floodplain of intermittent stream, approach is eroding.	Hydrologically stabilize unauthorized route.
8J002.3 - 7	200	40-Medium-High	Head-cutting intermittent stream, moving toward what appears to be an old sediment holding pond full of sediment.	Hydrologically stabilize, remove all fill.
8J002.3 - 8	40	20-Medium-Low	Intermittent stream. Unauthorized route in stream for 300 feet. A lot of fill in stream. Appears to be old mine area.	Hydrologically stabilize unauthorized route.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
8J002.3A - 1	100	35-Medium-High	Old 18" culvert under 100 cubic yards of fill. Not stable.	Hydrologically stabilize crossing, remove pipe and all fill.
8J002.3B - 1	20	20-Medium-Low	Ephemeral swale flow causing gully in unauthorized route.	Hydrologically stabilize road, remove fill, reestablish natural drainage.
8J002.3B - 2	90	35-Medium-High	Gully on unauthorized route bed. Needs to be revegetated.	Reestablish natural drainage. Remove fill. Help to revegetate.
8J002.3B - 3	10	15- Low	Gully on unauthorized route surface.	Hydrologically stabilize.
HUM096	20	15- Low	Rill on trail surface and sediment basins filled or filling.	Restore natural drainage. Armor crossings. Outslope. Maintain sediment basins.
HUM096	20	15- Low	Rill on trail surface and sediment basins filled or filling.	Restore natural drainage. Armor crossings. Outslope. Maintain sediment basins.
HUM096	20	15- Low	Rill on trail surface and sediment basins filled or filling.	Restore natural drainage. Armor crossings. Outslope. Maintain sediment basins.
HUM096	20	15- Low	Rill on trail surface and sediment basins filled or filling.	Restore natural drainage. Armor crossings. Outslope. Maintain sediment basins.
HUM096	20	15- Low	Rill on trail surface and sediment basins filled or filling.	Restore natural drainage. Armor crossings. Outslope. Maintain sediment basins.
HUM096	20	15- Low	Rill on trail surface and sediment basins filled or filling.	Restore natural drainage. Armor crossings. Outslope. Maintain sediment basins.
HUM096	20	15- Low	Eroding ephemeral stream channel.	Armor.
HUM096	20	15- Low	Rill on trail surface and sediment basins filled or filling.	Restore natural drainage. Armor crossings. Outslope. Maintain sediment basins.
HUM096	20	15- Low	Rill on trail surface and sediment basins filled or filling.	Restore natural drainage. Armor crossings. Outslope. Maintain sediment basins.
HUM096	20	15- Low	Rill on trail surface and sediment basins filled or filling.	Restore natural drainage. Armor crossings. Outslope. Maintain sediment basins.
HUM096	20	15- Low	Rill on trail surface and sediment basins filled or filling.	Restore natural drainage. Armor crossings. Outslope. Maintain sediment basins.
HUM096	20	15- Low	Rill on trail surface and sediment basins filled or filling.	Restore natural drainage. Armor crossings. Outslope. Maintain sediment basins.
HUM097	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM097	10	15- Low	Rill on trail.	Outslope.
HUM098	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM098	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM098	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
HUM098	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM098	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM098	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM098	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM098	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM098	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM098	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM098	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM098	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM098	20	15- Low	Rill and gully erosion on ridgetop trail. Sediment has filled in turnouts.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM098	20	15- Low	Trail on toe of ridge, active rill and gully erosion with sediment catch basins filling and breaching.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM099	20	15- Low	Trail on toe of ridge, active rill and gully erosion with sediment catch basins filling and breaching.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM099	20	15- Low	Trail on toe of ridge, active rill and gully erosion with sediment catch basins filling and breaching.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM099	20	15- Low	Trail on toe of ridge, active rill and gully erosion with sediment catch basins filling and breaching.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM099	20	15- Low	Trail on toe of ridge, active rill and gully erosion with sediment catch basins filling and breaching.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM099	20	15- Low	Trail on toe of ridge, active rill and gully erosion with sediment catch basins filling and breaching.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM099	20	15- Low	Trail on toe of ridge, active rill and gully erosion with sediment catch basins filling and breaching.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.
HUM099	20	15- Low	Trail on toe of ridge, active rill and gully erosion with sediment catch basins filling and breaching.	Maintain sediment basins and outslope where possible. Otherwise, improve drainage in any way possible.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
HUM103 - 0.27	50	40-Medium-High	Gully in steep portion of through-cut trail section depositing sediment directly into stream channel.	Disconnect trail from stream and reroute trail.
HUM104	10	15- Low	Ephemeral stream crosses trail. Small active erosion in gully.	Armor crossing.
HUM104	10	15- Low	Ephemeral stream crosses trail. Small active erosion in gully.	Armor crossing.
WIN001	10	15- Low	Two gullies on unauthorized route below 46N24 from runoff concentrating on road.	Outslope/hydrologically stabilize unauthorized route and fix road surface runoff.
WIN004	10	15- Low	Old unauthorized route is in channel with gully adjacent to roadbed.	Hydrologically stabilize
WIN005	30	15- Low	Steep gullied unauthorized off-highway vehicle trail off of 104 next to an intermittent stream is depositing sediment into the stream channel.	Hydrologically stabilize, disconnect.
WIN006	30	30-Medium-Low	Off-highway vehicle trail uses old roadbed with stream crossing removed, however spoils left in channel. Channel diverts 10'. Remove fill.	Remove fill.
WIN008	10	15- Low	Lead out ditch with catch basin from off-highway vehicle trail is perched above granitic inner gorge. Basin could overtop, sending runoff onto granitic inner gorge.	Cut off trail surface runoff before it enters sediment basin. Direct onto more stable or vegetated landform
WIN009	200	40-Medium-High	Mine site includes open adits. Perennial stream dammed and diverted into an ephemeral channel with large spoils/tailing pile that constricts new channel toward hillside that is now unstable.	Remove fill from stream course. Establish which channel is original channel and reinstall stream to it. Partial channel reconstruction may be required.
WIN010	7	15- Low	Gully from road runoff depositing sediment to intermittent stream channel.	Engineering fix has not been proposed as of yet.
WIN012*	50	35-Medium-High	Through cut road design with significant gullies.	Improve sediment catch basins and rolling dips.
WIN013*	15	15- Low	Rills on road surface, exit in dip.	Improve sediment catch basins and dips.
WIN014	593	30-Medium-Low	Fill and tailings in perennial stream channel, channel slowly cutting into fill. A collapsed mining cabin is on top of site.	Not feasible.
WIN016	20	20-Medium-Low	Gully on trail segment filling sediment catch basins and depositing sediment into ephemeral drainage. Active erosion.	Improve trail drainage.
WIN019	50	35-Medium-High	Waterbreaks on bottom of steep section of trail at intersection with the county road continuing to fail. Sediment being delivered into inboard ditch of county road.	Engineering fix has not been proposed as of yet.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
WIN020	100	35-Medium-High	Fill in intermittent channel from a mining ditch. Channel has breached the ditch and is cutting through fill actively. A lot of fill left.	Remove fill, hydrologically stabilize.
WIN021	200	40-Medium-High	Active diversion of perennial stream. Ditch has few locations where occasional failures during high flow causes gully (extension of 7H002 county road). Ditch busted. Active erosion.	Cut off flow to ditch if possible. Hydrologically stabilize ditch.
WIN022	500	15- Low	Perennial tributary to Humbug Creek conveyed through mine tailing via 30 inch undersized culvert. Fill is all rock tailings so aquatic organism passage is a bigger concern, but definitely impairing stream function.	Engineering fix has not been proposed as of yet.
WIN024	20	15- Low	300 foot gully along unauthorized route used by off-highway vehicles. Gully is delivering sediment to intermittent stream channel and cutting fill slope at channel crossing.	Install dips or water bars on unauthorized route segment or outslope if possible.
WIN026	30	15- Low	Unauthorized route used as unauthorized off-highway vehicle trail up ephemeral channel and steep granitic banks. Rill and gully erosion contributing sediment to channel.	Rehabilitate gully and block off-highway vehicle use.
WIN027	50	35-Medium-High	Unauthorized route used as unauthorized off-highway vehicle trail. Unauthorized off-highway vehicle concentrated use up ephemeral channel. Disturbance leaving hill slopes bare and delivering sediment into channel.	Block off-highway vehicles.
WIN030	100	40-Medium-High	An earthen dam (30-50 cubic yards) on intermittent channel has failed and steep sides of breached opening are eroding into channel. Head-cut is migrating up through sediment trapped behind dam.	Remove the rest of the dam and excavate sediment.
WIN031	250	40-Medium-High	Large gully forming because inboard ditch flow on county road above exits road and enters ephemeral drainage, overwhelming its capacity and actively scouring.	Disconnect ditch from ephemeral drainage.
WIN033	203	45-Medium-High	User created off-highway vehicle route exits unauthorized trail and goes up inner gorge of ephemeral drainage creating long gullies.	Block unauthorized off-highway vehicle trail and try to rehabilitate and revegetate.
WIN034	100	35-Medium-High	Unauthorized off-highway vehicle trail driving up steep ridge nose. Gully in trail.	Block unauthorized off-highway vehicle trail and place water bar above steepest part to cut off flow and drain onto hillslope rather than collect.
WIN035	40	30-Medium-Low	Unauthorized off-highway vehicle trail driving up nose of ridge. Creating long rill 300' x 2' x 2'.	Block unauthorized off-highway vehicle trail and restore natural condition. Might fix on its own if allowed to revegetate.

Site ID (Road Number and Mile Post)	Fill Volume	Overall Rating (rating and range)	Description of Current Condition	Required Work, Notes on Treatment
WIN036	40	25-Medium-Low	Unauthorized off-highway vehicle trail driving up nose of ridge. Creating long rill 300' x 2' x 2'.	Block unauthorized off-highway vehicle trail and restore natural condition. Might fix on its own if allowed to revegetate.
WIN037	40	25-Medium-Low	Unauthorized off-highway vehicle trail driving up nose of ridge. Creating long rill 300' x 2' x 2'.	Block unauthorized off-highway vehicle trail and restore natural condition. Might fix on its own if allowed to revegetate.
WIN038	40	25-Medium-Low	Unauthorized off-highway vehicle trail driving up nose of ridge. Creating long rill 300' x 2' x 2'.	Block unauthorized off-highway vehicle trail and restore natural condition. Might fix on its own if allowed to revegetate.
WIN039	40	25-Medium-Low	Rill on unauthorized off-highway vehicle trail.	Block off-highway vehicle access and allow to revegetate.
WIN040	40	25-Medium-Low	Rill on unauthorized off-highway vehicle trail.	Block off-highway vehicle access and allow to revegetate.

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APPENDIX F: AQUATIC CONSERVATION STRATEGY

The Forest Plan contains the components, objectives and standards and guidelines for the Aquatic Conservation Strategy as recommended by the 1994 Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning documents Within the Range of the Northern Spotted Owl (also known as the Northwest Forest Plan). The four components of the Aquatic Conservation Strategy, as given on pages 4-25 through 4-27 of the Forest Plan, are: 1) establishment and management of **Riparian Reserves**; 2) **Key Watersheds**; 3) **Watershed Analysis**; and 4) **Watershed Restoration**.

The Craggy Project does not occur in a **Key Watershed**; the project interdisciplinary planning team used information from the **Humbug Ecosystem Analysis** (watershed analysis, USDA 1993) when locating and designing the proposed activities, and the project is recognized as one step toward overall forest health. **Watershed Restoration**, which includes fish passage improvement, decommissioning of roads, and storm damage repair, is an ongoing program on the Forest. The Craggy Project does not propose direct watershed restoration but action alternatives will reduce the amount of watershed degradation that can occur from a high intensity wildfire in the area by changing vegetative condition classes to reduce the extent and intensity of a wildfire.

Activities in **Riparian Reserves** were developed to improve, protect or have neutral effects to riparian reserve conditions in the long term. Particular objectives were designed for thinning in riparian reserves (see Table 2-1 for the list of project design features and Appendix A for treatment prescriptions). Activities in riparian reserves consist of mechanical thinning, underburning, water withdrawal, mastication, legacy site restoration activities, and construction of up to two temporary stream crossings (depending on the final selected alternative). These activities were evaluated to determine the effects to riparian reserves at the 5th field watershed scale in the long term to meet the requirements in the 2007 direction for the Aquatic Conservation Strategy (USDA 2007). The effects of these activities were evaluated in detail in the Hydrology Resource Report for the project and the Aquatic Resources Report, both available on the project website. As the Forest fisheries biologist, Brian Thomas concluded that the proposed activities in Riparian Reserves met the Aquatic Conservation Strategy objectives, as stated on page 4-6 of the Forest Plan, because there were no significant changes to the primary processes affecting the aquatic conservation strategy objectives (stream temperatures or flow and sediment regimes). Also, by maintaining habitat conditions in the long term and minimizing direct impacts, there should be no change to aquatic biota within the project area (see the Aquatic Species Resources Report).

5th field watersheds in the project area:

Humbug Creek-Klamath River: The principal stream in this 5th field watershed is the mainstem of Humbug Creek. Anadromous and resident fish occur in Humbug Creek approximately 0.01 mile downstream from proposed project activities.

Yreka Creek-Shasta River: The principal streams in this 5th field watershed are the mainstem of Yreka Creek and Shasta River. Anadromous and resident fish occur in both

streams. The nearest proposed project activities to Yreka Creek occur approximately 1.4 miles upstream and upslope from the creek.

Since the closest project activities to Yreka Creek are approximately 1.4 miles upstream and do not include any instream activities, this analysis is more meaningful at the Humbug Creek-Klamath River watershed scale and over the analysis area, which reflects impacts to the mainstem of the Klamath River. Effects to surface erosion, mass wasting, and flow regime are indicated by the use of three models; the applicable results are displayed on [the Project website](#) in the Cumulative Watershed Effects document. Per the hydrologist's and geologist's review of the modeled values, the risk of affecting watershed conditions is not significant – with the risk of impacts to the sediment regime below 1.0 after implementation of the Craggy Project and then a reduction in risk by implementing future actions (see the Cumulative Watershed Effects document on the project website). The modeled values are clarified and verified by field review and professional experience at the site level to determine impacts to Aquatic Conservation Strategy objectives. Following are the nine objectives as listed on page 4-6 of the Forest Plan, a summary of how the Craggy Project will affect these objectives, and a determination that the Craggy Project will either restore, maintain, or prevent attainment of these objectives.

For the purposes of this report a determination of “restore” means that the project will move the Humbug watershed to the desired conditions. A determination of “partially restore” means that the project will move the Humbug watershed closer to the desired condition than is the current condition. A determination of “maintain” means that the project will not further degrade the current condition of the Humbug watershed. A determination of “prevent attainment of” means that the project will have a significant negative effect.

Alternatives 2 and 3

Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Watershed complexity, in this analysis, takes into consideration effects to large wood recruitment, the distribution of large trees in riparian reserves, coarse woody debris on the hillslopes, and the drainage network.

Little quantitative data is available regarding the range of historic variability of large woody debris, coarse woody debris and large trees in Riparian Reserves. Assumptions can be made considering the history of disturbance. The sources of large woody debris and coarse woody debris have likely been severely reduced from historical conditions by the 1955 haystack fire, which consumed vegetation on over approximately 70 percent of the Humbug Creek watershed; and salvage logging efforts in 1956 and 1957. These natural and human caused effects have reduced the occurrence of large conifers.

The Craggy Project is proposing thinning with mechanical fuel treatment and underburning to reduce fuel loading, promote forest health, and simultaneously leave material to provide diversity and complexity. The treatments will move the vegetative community in treated areas closer to that which occurred historically with greater structural diversity, less homogeneous species composition and larger trees in the long term (see the Silviculture Resource Report). Reduced fuel loading would help stands progress toward conditions where the natural fire regime is restored. Also, thinning activities are expected to increase conifer

size and help restore large wood recruitment, the distribution of large trees in riparian reserves, and coarse woody debris on the hillslopes in the long term. In Alternatives 2 and 3, treatments would occur and benefits would be observed in the outer portion of the Riparian Reserve buffers as determined by the project hydrologist. Treatments within Riparian Reserves were determined by the potential to maintain or restore the Aquatic Conservation Strategy Objectives and have no effect to shade. Riparian Reserve treatment and buffers including equipment exclusion buffers are described in detail in Appendix A of the Hydrology Resource Report. The exclusion of treatment within the inner portion of the Riparian Reserves and the project design features for prescribed burning will also prevent any removal of existing large woody debris in the stream channel. There will be no substantial effect to peak flows or debris flow potential as a result of the project, so the potential transport of large woody debris will be maintained.

Alternatives 2 and 3 would **partially restore** the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic system to which species, populations and communities are uniquely adapted in the short and long-term.

Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic- and riparian-dependent species.

Watershed connectivity, for this analysis, takes into consideration the effects to aquatic species, fish, and riparian dependent terrestrial species passage in the project area.

Watershed connectivity would have historically ranged from high to moderate on any given section of Humbug Creek. Particularly, Upper and Middle Fork Humbug Creek have a high likelihood of landslides, as found in the Geology Resource Report. The mass wasting cumulative watershed effects model (GEO) assumes a winter storm event with a 10-year return interval (Bell 2012). Based on that assumption, at any given time there would have been a percentage of stream channels recovering from debris flow and landslide impacts that would have scoured channels and stripped vegetation from the riparian area. Small fires and blow-down would have left small openings in the canopy of riparian reserves as well. Natural disturbances such as wild fire, log jams, landslides, and associated debris flows would have been the primary means of preventing passage in the project area by aquatic species, fish, and riparian dependent terrestrial species.

These impacts would have been smaller and better distributed in the watershed than they are today, as stands are densely stocked with high fuel loading. Also, high road density has increased landslide risk in the watershed (Geology Resource Report) which negatively effects watershed connectivity. Undersized road drainage structures prevent passage of aquatic organisms, however, only one such barrier is known and it exists on private land on lower Humbug Creek (Aquatic Resources Report).

The Craggy Project proposes to treat hazardous fuels, and reduce stand densities throughout Humbug Creek. Some of these activities will be occurring in the outer portions of Riparian Reserves (see Appendix A of the Hydrology Resource Report). Treatments within Riparian Reserves are designed to create conditions that benefit riparian function by maintaining a heterogeneous species composition as well as encouraging large tree development. Fuel

treatment and thinning will improve riparian dependent terrestrial species passage in the project area. At the project scale, in the long-term Alternatives 2 and 3 will improve migration routes for wildlife by opening dense stands to restore the greater connectivity that was historically present in these watersheds. Alternatives 2 and 3 will not prevent the attainment of this objective in the short-term and will contribute to the long-term improvement of watershed connectivity at the 5th field scale. Potential direct and indirect impact to aquatic resources will primarily occur as a result of water drafting and the use of a temporary crossing. Effects will be localized, small, and short-term. Other project components are either located in the uplands outside the Riparian Reserve, else adjacent to fishless streams far from fish-occupied waters. The use of project design features and Best Management Practices, along with distance, will reduce the short-term impact to aquatic resources. The project also proposes to treat legacy sediment sources by hydrologically stabilizing unauthorized routes and storm proofing several system roads (Hydrology Resource Report). This will reduce the risk of management related debris flows and therefore, improve aquatic organism and fish passage within the project area in the long term. The Craggy Project will not result in any physical or chemical condition that would hinder the movement of fish and other aquatic organisms or the migration routes for wildlife species in the short or long term.

Alternatives 2 and 3 would **partially restore** spatial and temporal connectivity between watersheds.

Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

Physical integrity of aquatic systems, in this analysis, will consider effect to the channel geomorphology and include evaluations of road density, hydrologic connectivity of road systems, and direct impact to bank and stream bottom.

The range of historic variability of physical integrity of aquatic systems within Humbug Creek would have been varied and heterogeneous. Most natural stream systems within areas of fairly stable geology and climate regime reach dynamic equilibrium, a state in which the hydro-geomorphic processes, though still changing at the site scale in response to disturbance (landslides, fires, large wood recruitment), are stable on the watershed scale. In this state, neither gross aggradation trends, nor incision is occurring at the watershed scale. There would have been a high percentage of Humbug Creek and tributaries with competent, overhanging banks, regularly inundated shorelines and floodplains with complex in-channel landforms and varied substrates.

Past management activities including salvage harvest and subsequent road building and most notably, mining; have severely affected channel geomorphology. A large percentage of perennial stream length within Humbug Creek has been mined. Historic mining has left behind coarse tailings piles that have constricted sediment transport, over-coarsened stream bottom composition, and reduced floodplain inundation. County maintained roads follow closely to the inner gorges of the major perennial streams in the project area (main stem Humbug creek, Middle Fork Humbug Creek, South Fork Humbug Creek). Off-highway vehicle trails with persistent gully and rill features also exist. These management related impacts have increased the hydrologic connectivity of surface runoff as well as ditch lines to water courses. This in turn has likely lead to increased peak flows during storm events.

Therefore, the existing condition of Humbug Creek is such that this objective is not being attained.

The risk of affecting the physical integrity of the aquatic system is not significantly changed by action alternatives in the Craggy Project since water temperature, flow, and sediment regimes are not significantly altered, as shown in the tables in the cumulative watershed effects results and discussed in both the Hydrology and Aquatic Resource reports. Effective road density will decrease as a result of unauthorized route hydrologic stabilization associated with the legacy site treatments required by the 2015 Waiver. Storm proofing activities on system roads will reduce the connected ditch lengths in some areas.

Alternatives 2 and 3, though not restoring the impairments from past mining activities, **partially restore** this objective due to legacy site treatments. Proposed activities other than legacy site treatments will not prevent attainment of this objective.

Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction and migration of individuals composing aquatic and riparian communities.

As a tributary of the Klamath River, Humbug Creek is listed in the 303 (D) Clean Water Act for nutrients and temperature (hydrology resource report). The water quality analysis for this project uses stream shade as a proxy for temperature of the stream. A discussion of human caused sediment (which is a water quality concern as well), will be discussed in detail within the next objective.

The historic range of variability concerning shade and instream temperature is largely unknown due to lack of quantitative data. Larger conifer size within riparian reserves historically, as is the likely the case, combined with a dense, diverse riparian vegetation community, likely provided more shade on the watershed scale than is the current condition. However, as previously noted, fire and landslides (and subsequent debris flows) were common natural disturbances that would have reduced stream shading at site and reach scales.

The current condition has been documented through ongoing data collection, last summarized in 2010 and 2011. The data showed that Humbug Creek had an average existing shade condition of 89 percent, which is more than the desired amount being 69.7 percent (Hydrology Resource Report) and maximum weekly maximum stream temperature that slightly exceeded the core juvenile rearing standard of 16 degrees Celsius (17.6 degrees Celsius in 2010, and 16.5 degrees Celsius in 2011). Though these data indicate an exceedance and a water quality impairment, Humbug Creek is not severely degraded, in terms of stream temperature or shade.

The Craggy Project overall, including activities proposed within Riparian Reserves, will have minor direct, indirect, and cumulative effects on water quality and land stability within the project area. Alternatives 2 and 3 reduce the potential risks of high intensity wildfire, and project design features reduce the risk of negative effects from project implementation to water quality. Also, the Hydrology Resource Report shows that silvicultural treatments within Riparian Reserves will have no effect to stream shade. Therefore, in the long term,

reduced risk of landsliding from legacy site treatments, reduced risk of high intensity wildfire from thinning and fuel reduction, and increasing the overall size of conifers will have a direct and indirect positive effect to stream shade and therefore stream temperature.

Alternatives 2 and 3 would **partially restore** water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.

Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the regime include the timing, volume, rate and character of sediment input, storage, and transport.

The sediment regime analysis will consider the effect to sediment delivery to streams as measured by legacy sediment sources.

The range of historic variability of sediment delivery to streams was likely not wide. As discussed above landslides and fires were a critical historic disturbance that occurred commonly. Humbug Creek and its tributaries were likely adapted to the large episodic inputs of sediment from these disturbances. Additional sources of sediment was chronic inner gorge erosion as channels migrated across their floodplains. This type of erosion was a vital source of fine sediment and gravels to the streams for healthy fish populations. Watershed-scale geomorphic processes were likely in a dynamic equilibrium between bed load and stream flows.

As discussed above, mining has severely impaired the geomorphological processes of Humbug Creek and its tributaries. These geomorphological effects (i.e., how sediment interacts with stream flow once it is in or near the stream) are not considered here; rather, sediment delivery to streams is the primary focus.

The current condition of sediment delivery to streams is grossly elevated over the historic range of variability. Nearly 50,000 cubic yards of sediment have the potential to be delivered to Humbug Creek and its tributaries from the inventoried legacy sediment sources (Hydrology Resource Report). Sources are highly varied and include:

- chronic gully and rill erosion from steep ridge-climbing off-highway vehicle trails
- un-armored stream crossings of roads and OHV trails
- large fills over stream crossings in undersized pipes
- stream crossings with potential or active diversion resulting from improper road design
- chronic erosion of road fills on unauthorized routes which have not been hydrologically stabilized

Finally, as noted above, county roads are built along almost every major stem of Humbug Creek. Though they receive regular maintenance they feature eroding ditch lines that are hydrologically connected to watercourses and undersized culverts. These sites are not legacy sediment sites because they are not Forest managed; however, they are a noteworthy contributor to the existing condition of Humbug Creek.

The Craggy Project proposes using Forest system roads and county roads as haul routes. These activities could have an insignificant negative effect to sediment delivery to streams as some of the legacy sediment sources could be worsened. However, most legacy sediment sources on haul routes are undersized culverts and diversion potentials on stream crossings

which will not be affected by timber operations. Another possible direct negative effect could be from the construction of new skid trails and temporary roads and landings, including the use of existing landings and temporary roads. These effects will likely be less than significant as a result of implementation of best management practices and project design features. New and existing temporary roads and skid trails would be hydrologically stabilized prior to the completion of the project (BMP 2.3). The Craggy Project action alternatives are proposing, in compliance with the 2015 Waiver, to treat approximately 78 legacy sites (the number is not final until the project is enrolled under the Waiver which will take place after the record of decision). To the extent possible, legacy sediment sites and road segments with the highest risk to water quality will be chosen to be treated (Hydrology Resource Report). Treatments will involve hydrologic stabilization of unauthorized roads and stormproofing of Forest system roads (not all roads). These treatments will have a direct positive effect on sediment delivery to streams.

Alternatives 2 and 3 also propose thinning and fuel reduction activities which will increase stand health and decrease risk of large severe wildfires in the long term. Reducing the risk of stand-replacing fire and progressing towards a natural fire regime in the long term would have the most influence on maintenance and restoration of the sediment regime. The total long-term sediment production is predicted to be lower if areas are thinned and burned under controlled conditions as compared to a high intensity and severity wildfire.

Therefore, Alternatives 2 and 3 would **partially restore** the sediment regime under which aquatic ecosystems evolved.

Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats, and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

The water quantity analysis considers the effect to base flow and peak flow using a qualitative assessment.

The historic range of variability for base and peak flows ranges from 100-year flood events, like the flood of 1964 to 1965, to drought years where snow pack is less than 10 percent of the known average in some areas. The spring-fed perennial streams have less variation in their base flows than snow-melt driven intermittent streams from year to year. Large fires can increase peak flows because of the reduction in precipitation interception and infiltration rates.

The proposed activities include thinning forested areas, controlled introduction of fire, and post-harvest fuel treatment; water drafting would take place in support of the proposed activities, this is not expected to noticeably reduce stream flows, no other activities are planned that would directly divert or reduce stream flows. There may be a short-term lessening of evapotranspiration levels in the area, resulting in an increase in phreatic and vadose flows. This will be offset in the long term by increased stand vigor and fire resiliency. At the 5th field watershed scale, and over the entire analysis area, no changes in flows are expected from the action alternatives.

Alternatives 2 or 3 would **maintain** in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats, and to retain patterns of sediment, nutrient, and wood routing.

Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows.

Historic range of variability regarding floodplain inundation would be based on the type and landscape position of streams within Humbug Creek. Headwater, cascade and streams with large substrate and high gradients typically are confined and lacking a significant floodplain naturally. Response reaches with gradients at or below five percent typically have well defined floodplains that are actively inundated on a yearly basis. This floodplain inundation supported a diverse and thriving riparian vegetation community and facilitated ecosystem functions such as sediment retention, water filtering, and water cooling through groundwater interaction.

The existing condition of floodplain interaction is severely degraded as compared with the historic range of variability. Main stem Humbug Creek and all perennial forks that are response reaches have floodplains that are largely disconnected. Because of the over-coarsening of the stream beds due to tailings piles, these streams are not significantly incised, but rather tailings piles have confined the channels and largely disconnected floodplains from their channels, limiting floodplain inundation to very large storm events. High gradient, headwater intermittent streams, though degraded by mining as well, have not suffered as notably being that their natural channel form does not usually exhibit a large floodplain. This objective is not being attained under existing conditions, and it is prevented by the historic effects from mining.

The Craggy Project proposes no activities that will exacerbate the existing impaired condition, or further disconnect streams from floodplains. Additionally because this project is proposing thinning, any effects to the water table would be negligible because the remaining stand after thinning would be more vigorous and efficient as an evapotranspiration mechanism. There will be no treatments in meadows.

Therefore, either Alternative 2 or Alternative 3 would **maintain** the timing, variability, and duration of floodplain inundation and water table elevation in meadows, even though this objective is currently not being attained.

Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris to sustain physical complexity and stability.

This analysis will consider the expected response of conifer and hardwood trees in the portions of Riparian Reserves that are being treated.

Historic range of variability concerning the structural diversity of plant communities in riparian areas is largely unknown. It can be assumed that the terrestrial, outer portions of riparian reserves were historically populated by larger, less densely stocked conifers. It can also be assumed that the true riparian plant community was diverse and robust, providing adequate shading and habitat.

The Craggy Project is treating only the outer portions of some Riparian Reserves (Hydrology Resource Report, Appendix A) where there will be no negative effects to Aquatic Conservation Strategy objectives and there is a great need for fuel reduction or improvement

to stand health. The activities in Riparian Reserves do not adversely affect the plant communities in riparian areas. Species composition of plant communities in riparian areas would be **maintained** during project implementation and protected in the long term by reducing the risk of stand-replacing fires. Structural diversity of the vegetation in riparian areas would be **partially restored** by allowing fire to burn in low intensity in riparian areas, prohibiting active treatment in riparian vegetation and leaving snags in areas connected to the aquatic system.

Maintain and restore well distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

Reducing the risk of a stand-replacing fire increases the likelihood of maintaining a well-distributed mix of habitats. Olson and Agee (2005) concluded from their study of fires in riparian forests, that it will be necessary to reintroduce fire to riparian forests in order to restore forests to historical conditions. They also observed that, “if upslope forests are treated for fuels reduction [as for this project], either with prescribed fire or other silvicultural treatments, then perhaps a wildfire ignited within the upslope forest would be less likely to gain the intensity needed to burn within the moister portion of the riparian zone.” The proposed fuel reduction is designed to reduce fuels in the upslope areas and in portions of Riparian Reserves to change fire behavior in a way that is more similar to historic, desired conditions that will promote native plant and invertebrate riparian dependent species.

Therefore, either Alternative 2 or Alternative 3 would **partially restore** habitat to support well distributed populations of native plant and invertebrate riparian dependent species.